BUILDING MATERIAL CATALOG

HOUSTON BROTHERS COMPANY
PITTSBURGH, PA.

25.00

CATALOG No. 10

ILLUSTRATING AND DESCRIBING A COMPLETE LINE OF BUILDERS MATERIALS AND SUPPLIES

¶ A COMPLETE TREATISE FOR THE READY REFERENCE OF DEALERS, ARCHITECTS AND THE GENERAL BUILDING TRADES

HOUSTON BROTHERS COMPANY
PITTSBURGH, PA.

WE ARE accessibly located to render the maximum degree of service. In the South Side, East Liberty, Lawrenceville and other sections, we have yards and shipping and storage facilities that promote convenience and fast service. It is a Houston policy to do more than merely sell a commodity—you secure in addition a certain degree of attention and service that helps to better meet your needs.

INTRODUCTION

HAT qualities must a building supply house have to merit your custom and confidence?

We believe that an institution such as ours should have a long record of honest service and intelligent co-operation with the building trades. The fact that our company is one of the oldest building supply houses in the United States is ample proof of our integrity.

Permanency can only be founded on the solid rock of goodwill. An examination of our records will disclose the fact that we have many active accounts that date back to the first year of our business life.

The members of our company have a real interest in the manufacture of our products, owning and controlling stock in a number of plants whose output we absorb. Uniform excellence of materials is thus doubly assured.

Our system of purchases, which reduces handling to a minimum, enables us to quote very favorable prices, no matter what the line of goods or the quantity may be.

Above all, we are specializing in service — a real service that has won us many staunch friends and is sure to merit your favorable opinion.

FACILITIES *and* SERVICE

IT is a byword with building supply dealers and the allied trades that Houston Brothers Company deliver the goods on schedule. It has required the closest attention to detail to merit this reputation and it is needless to state that we will do all in our power to continue to live up to it.

In order that we may instantly supply your needs, we have established distributing yards in all parts of the city, each of which carries at all times a complete and fresh stock of standard lines. The principal railroads discharge freight on our private sidings, enabling our trucks to deliver special orders direct from the cars. Days and even weeks are often saved by this method of handling.

Our great fleet of trucks reach every part of the city and outlying districts in a remarkably short space of time, providing a service that is sure to be appreciated by the up-to-date builder and dealer.

Our central location, together with conveniently located distributing yards, brings the out-of-town customer to our very door. A thoroughly modern transportation system reduces delivery expenses to the minimum.

We would welcome the opportunity to demonstrate the efficiency and economy of our methods.

TERMS *and* CONDITIONS

Sewer Pipe, Clay Goods, Portland Cement Lime, Roofing, Slate, Etc.

TERMS on these materials in carload lots same as those established by the manufacturers of same. No exception thereto will be allowed.

On less carload shipments from factory or Pittsburgh: 30 days net or 2% off for cash, 10 days from date of invoice. Steel Sash net.

General

Where goods are sold freight allowed—Cash discount will not apply on the freight.

Notice

Your order will be entered on our books in accordance with the preceding specifications, subject to the approval of the Pittsburgh office. If not correct, advise the Pittsburgh office by mail or telegraph.

Cloth Bags

For shipment of cement in cloth, the bags are included in the price and are sold with the material. These bags are payable when the invoice is due and cannot be deducted. If they are returned and received at our mill in good condition, freight prepaid, within 60 days from the delivery of the cement, we will purchase them from you, subject to mill count and inspection. All prices subject to market changes.

Breakage

Breakage (if any) of clay goods—sewer pipe, hollow brick, lime and cement—in transit, at your risk.

Claims

All claims for damaged, short or unsatisfactory material must be made in writing immediately on receipt of goods.

Sewer Pipe and Fittings

V Branch

Running Trap

Double Y

1 Foot Slant

Bowl—Small End Increaser

Bowl—Large End Reducer

Cut Curve

Cut Elbow

Double T

P Trap

T Branch

⅛ Bend, 1 Foot Long

Elbow

Y Branch

Sewer Pipe and Fittings

OUR salt glazed vitrified sewer pipe, manufactured of specially selected fire clay, is as hard as granite. We have never heard of a single instance where our sewer pipe, properly laid and bedded, has been crushed by the weight of filling in any depth cut. It will not deteriorate under chemical or atmospheric action. In construction work, as in everything else, the best is the cheapest in the end.

PRICE LIST OF SEWER PIPE

Effective Sept. 20, 1916

Approximate Weight, Dimensions, Etc., of Standard Sewer Pipe

Calibre	Price per Foot	Weight per Foot Pounds	Depth of Socket Inches	Annular Space Inches	Thickness Inches
3	$ .30	7	1½	¼	½
4	.30	9	1⅝	⅜	½
5	.45	12	1¾	⅜	⅝
6	.45	15	1⅞	⅜	⅝
8	.70	23	2	⅜	¾
9	1.05	28	2	⅜	13/16
10	1.05	35	2⅛	⅜	⅞
12	1.35	45	2¼	½	1
15	1.80	60	2½	½	1⅛
18	2.50	85	2¾	½	1¼
20	3.00	100	3	½	1⅜
22	4.00	130	3	½	1⅝
24	4.50	140	3¼	½	1⅝
27	6.50	224	4	¾	2
30	7.20	252	4	¾	2⅛
33	9.00	310	5	1¼	2¼
36	10.25	350	5	1¼	2½

Discounts governing price 3 to 24 inch will not apply on 27 to 36 inch.

DOUBLE STRENGTH PIPE

Calibre	Price per Foot	Weight per Foot Pounds	Depth of Socket Inches	Annular Space Inches	Thickness Inches
15	$ 1.80	75	2½	½	1¼
18	2.50	118	2¾	½	1½
20	3.00	138	3	½	1⅝
22	4.00	157	3	½	1⅝
24	4.50	190	3¼	½	2
27	6.50	265	4	¾	2¼
30	7.20	290	4	¾	2½
33	9.00	335	5	1¼	2⅝
36	10.25	375	5	1¼	2¾

List prices on clay goods, subject to change.

Approximate Weights, Dimensions, Etc.

DEEP AND WIDE SOCKETS—STANDARD

Calibre Inches	Thickness Inches	Weight per Foot Pounds	Depth of Sockets Inches	Annular Space Inches
4	½	10	2	½
5	⅝	12	2½	⅝
6	⅝	16	2½	⅝
8	¾	25	2¾	⅝
10	⅞	37	2¾	⅝
12	1	45	3	⅝
15	1⅛	70	3	⅝
18	1¼	90	3¼	⅝
20	1⅜	115	3½	⅝
21	1½	130	3⅝	⅝
22	1⅝	145	3¾	⅝
24	1⅝	150	4	⅝

DEEP AND WIDE SOCKETS—DOUBLE STRENGTH

Calibre Inches	Thickness Inches	Weight per Foot Pounds	Depth of Sockets Inches	Annular Space Inches
15	1¼	75	3	⅝
18	1½	118	3¼	⅝
20	1⅔	138	3½	⅝
21	1¾	148	3⅝	⅝
22	1⅚	157	3¾	⅝
24	2	190	4	⅝

The list price of Fittings is the same as on Standard Pipe Fittings.

Discounts governing price 2 to 24 inches will not apply to 27 to 36 inches.

STANDARD SEWER PIPE

Calibre Inches	Thickness Inches	Weight per Foot Pounds	Depth of Sockets Inches	Annular Space Inches
3	½	7	1½	¼
4	½	9	1⅝	⅜
5	⅝	12	1¾	⅜
6	⅝	15	1⅞	⅜
8	¾	23	2	⅜
9	13/16	23	2	⅜
10	⅞	35	2⅛	⅜
12	1	45	2¼	½
15	1⅛	60	2½	½
18	1¼	85	2¾	½
20	1⅜	100	3	½
21	1½	120	3	½
22	1⅝	130	3	½
24	1⅝	150	3¼	½
27	2	224	4	¾
30	2⅛	252	4	¾
33	2¼	310	5	1¼
36	2½	350	5	1¼

DOUBLE STRENGTH PIPE

Calibre Inches	Thickness Inches	Weight per Foot Pounds	Depth of Sockets Inches	Annular Space Inches
15	1¼	75	2½	½
18	1½	118	2¾	½
20	1⅔	138	3	½
21	1¾	148	3	½
22	1⅚	157	3	½
24	2	190	3¼	½
27	2¼	265	4	¾
30	2½	290	4	¾
33	2⅝	335	5	1¼
36	2¾	375	5	1¼

Discounts governing price 3 to 24 inches will not apply to 27 to 36 inches.

Carrying Capacity of Sewer Pipe

THE size of the pipe required can be readily ascertained by referring to the following table, which shows the number of gallons discharged per minute by specified sizes and grades, providing the area to be drained and the fall of the sewer per 100 feet is definitely known. In main sewers the flow is greatly increased by the added pressure of connecting laterals.

Size of Pipe Inches	GALLONS DISCHARGED PER MINUTE							
	1-Inch Fall per 100 Feet	2-Inch Fall per 100 Feet	3-Inch Fall per 100 Feet	6-Inch Fall per 100 Feet	9-Inch Fall per 100 Feet	1-Foot Fall per 100 Feet	2-Foot Fall per 100 Feet	3-Foot Fall per 100 Feet
3	9	12	15	22	27	31	44	54
4	20	28	35	50	62	71	101	124
6	63	89	111	156	194	224	317	389
8	140	198	246	348	432	499	706	864
9	196	277	339	480	595	687	971	1,180
10	261	369	457	648	803	928	1,310	1,610
12	432	612	758	1,070	1,330	1,530	2,170	2,660
15	800	1,130	1,400	1,980	2,450	2,830	4,010	4,910
18	1,320	1,860	2,310	3,260	4,440	4,660	6,590	8,080
20	1,720	2,500	3,060	4,330	5,305	6,130	8,660	10,610
24	2,910	4,110	5,035	7,191	8,810	10,270	14,520	17,790
27	4,020	5,680	6,960	9,840	12,050	13,920	19,680	24,110
30	5,380	7,618	9,320	13,180	16,140	18,640	26,350	32,280
33	6,950	9,840	12,050	17,040	20,865	24,090	34,070	41,730
36	8,800	12,450	15,210	21,565	26,410	30,500	43,130	52,820

Sewer pipes have much greater carrying capacity than brick sewers of the same dimensions. According to statistics the maximum rainfall per hour is about one inch, except during very heavy or unusual storms.

For each acre one inch of rainfall per hour gives 22,633 gallons per hour, or 377 gallons per minute per acre. However, experience proves that on account of various obstructions, not over 50 or 75 per cent of the rain falling will reach the drain within the same hour. Therefore due allowance must be made for this fact in determining size of pipe required, severe storms generally being of short duration.

According to authorities these pipes have a carrying capacity 50 per cent greater than brick sewers of the same size.

NUMBER FEET STANDARD PIPE IN CARLOAD

On Present Carload Weight of 26,000 Lbs.

STANDARD PIPE				DOUBLE STRENGTH PIPE	
Size Inches	No. Feet	Size Inches	No. Feet	Size Inches	No. Feet
3	4,000	18	290	15	320
4	3,000	20	240	18	205
5	2,000	21	240	20	180
6	1,600	22	210	21	150
8	1,100	24	160	22	150
9	900	27	110	24	130
10	700	30	100	27	95
12	580	33	80	30	85
15	400	36	70	33	75
				36	65

Table Showing Cubic Yards of Excavation Required

Per Lineal Foot in Trenches of the Following Dimensions

Width	Depth in Feet					
Feet	4	6	8	10	12	14
2	0.30	0.44	0.59	0.74	0.89	1.04
2½	0.37	0.53	0.74	0.93	1.11	1.30
3	0.44	0.66	0.89	1.11	1.33	1.56
3½	0.52	0.78	1.04	1.30	1.56	1.82
4	0.59	0.89	1.18	1.48	1.78	2.07
4½	0.66	1.00	1.33	1.67	2.00	2.33
5	0.74	1.11	1.48	1.85	2.22	2.59
5½	0.82	1.22	1.63	2.03	2.44	2.85
6	0.89	1.33	1.78	2.22	2.66	3.11
6½	0.96	1.44	1.93	2.40	2.89	3.37
7	1.04	1.55	2.07	2.59	3.11	3.63
7½	1.10	1.66	2.22	2.77	3.33	3.89
8	1.18	1.78	2.37	2.96	3.55	4.15

Width	Depth in Feet					
Feet	16	18	20	22	24	26
2	1.18	1.33	1.48	1.63	1.78	1.93
2½	1.48	1.67	1.85	2.04	2.22	2.41
3	1.78	2.00	2.22	2.44	2.66	2.89
3½	2.07	2.33	2.59	2.85	3.11	3.37
4	2.37	2.67	2.96	3.26	3.55	3.85
4½	2.67	3.00	3.33	3.67	4.00	4.33
5	2.96	3.33	3.70	4.07	4.44	4.81
5½	3.26	4.67	4.07	4.48	4.89	5.30
6	3.55	4.00	4.44	4.89	5.33	5.78
6½	3.85	4.33	4.81	5.30	5.78	6.26
7	4.15	4.67	5.19	5.70	6.22	6.74
7½	4.44	5.00	5.55	6.11	6.67	7.22
8	4.74	5.33	5.92	6.52	7.12	7.70

Vitrified Slop and Closet Bowls

WITH OR WITHOUT STRAINERS

Slop Bowl

Closet Bowl

		List Price
12 x 4	each	$4.50
12 x 6	each	4.50
15 x 4	each	6.50
15 x 6	each	6.50

Grease Trap

Cellar Traps

		List Price
9 x 4 With Bottom	each	$ 9.00
Without Bottom	each	7.50
12 x 4 With Bottom	each	13.50
Without Bottom	each	9.00

Grease Traps

WITH BOTTOM AND COVER

		List Price
8 Inch	each	$10.00
9 Inch	each	15.00
10 Inch	each	18.00
12 Inch	each	18.00
15 Inch	each	24.00
18 Inch	each	30.00

Cellar Trap

Instructions for Laying Vitrified Sewer and Culvert Pipe

LAYING smaller sizes the following information may be found helpful:

Beginning at the lower end or outlet of the proposed sewer grade trench with the uniform inclination throughout its entire length.

Bring bottom of trench to exact uniform grade. Excavate a suitable depression for each hub to allow bottom of pipe when laid to have a full, firm bearing on the ground.

Begin laying the pipe at the outlet with all hubs facing up grade.

It is important to observe that pipe is laid on a solid bearing throughout the entire length, and that sides be carefully rammed to distribute pressure uniformly over the entire surface of the pipe.

In laying sizes from 8 inches up, it is safer to dig a narrow trench approximately 6 to 8 inches wide and 3 to 6 inches deep, according to size, in middle of trench, with depression for sockets, as indicated above. Being laid in this manner pipe will have a firm bearing along the sides, and if the loose earth is well tamped and rammed to a point above the center line of pipes, they will stand a maximum amount of pressure.

Where larger sizes are being used and the trenches are deep, or in railroad embankments where filling is put on after pipe is once laid, it is better to use double strength pipe, and in choosing the size to be used be sure to make liberal allowance for abnormal rainfall or conditions varying from the average.

Vitrified salt-glazed pipe is practically everlasting, hence the best of material and workmanship should be used in its installation. At the outlet or spill of culverts an apron should be formed of stone or concrete and carried sufficiently away from the face of the bank that there will be no danger of the earth being washed away.

When the soil is of such a character that the pipe cannot be properly supported by tamping, or very extraordinary conditions render the utmost precaution advisable, a concrete bed or foundation extending up the sides of the pipe to its horizontal center, and about six inches in thickness, will add greatly to the stability and durability of the work.

If it is desired to have a capacity greater than afforded by one pipe, two or more lines of pipe may be laid side by side, but the separate lines must be far enough apart to assure a solid bed for each line and to leave sufficient room to permit the filling to be thoroughly tamped along both sides of each individual line of pipe.

For waste or drain pipes where absolutely tight joints are not required, the cut of the pipe can be used without filling in sockets, but where tight joints are necessary, cement mortar may be used, consisting of one-half each cement and good sharp sand. Where mortar is used, the inside of the pipe should be left perfectly smooth, free from projections or lumps at any of the joints.

Fire Clay Chimney Tops

No. 23

No. 26

No. 16

No. 8

No. 21

No. 14

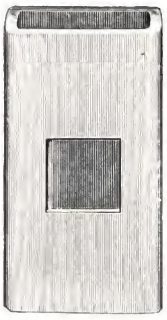
AS AN additional safeguard against fire, the use of Chimney Tops should be generally encouraged. Besides serving this useful purpose, they are highly ornamental, being furnished in a number of standard and special designs. The appearance of many a home is decidedly enhanced by the use of chimney tops, which lend it that finished appearance so often lacking in modern structures.

Our tops are made of specially selected and thoroughly hard-burned fire clay. Once installed, they are a permanent fixture. Prices are very reasonable.

No.	Height Feet	Shaft	BASE Kind	BASE Size Inches
8	2½	Octagon	Square	13 x 13
14	2½	Paneled	Square	13 x 13
16	2½	Octagon	Square	13 x 13
21	2	Cone	Square	13 x 13
23	3	Round	Square	13 x 13
26	3⅓	Round	Square	13 x 13

Fire Clay Flue Lining

Prevent Fires



TWENTY-THREE per cent of all fires are due to defective flues. Limiting this tally to fires in residential districts, the proportion of chimney fires amounts to two-thirds of the total. The best single protective measure against fire in the home is Fire Clay Flue Lining.

A single wall of brick between the flame and the beams or wooden flooring is not enough to protect you. Flue lining is cheaper and more effective than an added thickness of brick. Fire clay is the best fire resistant known to the trade and flue linings are endorsed by every authority on fire risk.

Fire Clay Flue Lining

Square or Round Corner

Outside Measure Inches	Price per Foot	Thickness Inches	Weight per Foot Pounds
4½ x 8½	$ .45	⅝	14
4½ x 13	.60	11/16	20
4½ x 18	1.20	13/16	40
7½ x 7½	.45	⅝	15
8½ x 8½	.60	21/32	20
8½ x 13	.90	25/32	30
8½ x 18	1.35	⅞	45
13 x 13	1.15	13/16	38
13 x 18	1.75	⅞	57
18 x 18	2.25	1	72

Openings and Registers 50% added.

Round Flue Linings

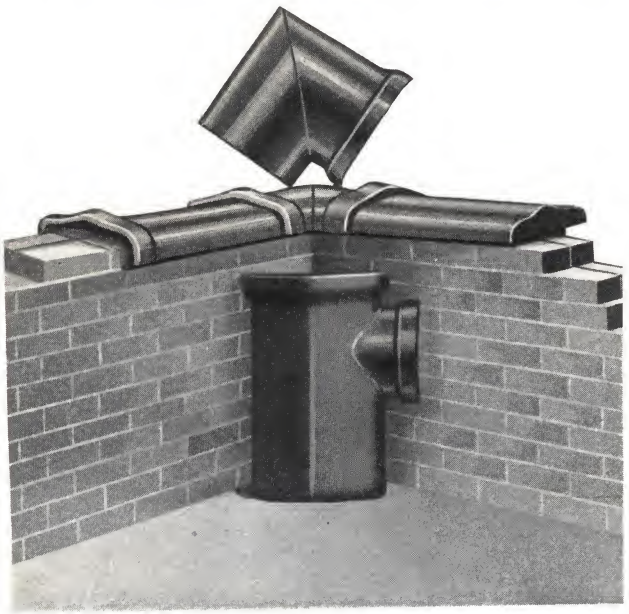
Without Sockets

Minimum Carload 35,000 Pounds

Inside Measure Inches	Price per Foot	Thickness Inches	Weight per Foot Pounds
6	$ .45	⅝	15
7	.55	11/16	20
8	.70	¾	23
9	1.05	13/16	28
10	1.05	⅞	35
12	1.35	1	43
15	1.80	1⅛	60
18	2.50	1¼	85
20	3.00	1⅜	100
22	4.00	1⅝	130
24	4.50	1⅝	140
27	6.50	2	224
30	7.20	2⅛	252
33	9.00	2¼	310
36	10.25	2½	350

Openings four times price of one foot of straight pipe.

Impermeable Vitrified Wall Coping



ONLY in recent years has the true importance of wall coping become apparent. Serving not only as an ornamental topping but also as an absolute protection against the destructive action of varying weather conditions, wall coping is an economical investment that is certain to pay big dividends. Rain, snow or erosion crumbles the mortar between the bricks of an exposed brick wall. Coping is an absolute preventative.

Our coping is salt-glazed and vitrified, positively impervious to moisture and carefully jointed. We maintain a complete stock at all times.

Size	Weight	List
8 and 9 in.	11 lbs. per ft.	$ .40 per lin. ft.
12 and 13 in.	16 lbs. per ft.	.60 per lin. ft.
18 in.	32 lbs. per ft.	1.20 per lin. ft.

Concerning Tile Drainage

AS ALL familiar with under drainage are aware, the soil is made mellow and deeper. Tiled land holds moisture much longer than untiled. It freezes deeper, thoroughly breaking up the ground and enabling the plant roots to go deeper into the soil.

Properly tiled, the rains enrich the soil, leaving nitrogen and ammonia taken from the air in falling. Thus chemical action inducing growth is greatly augmented. Only one installation of the tiling is needed to insure a crop in either wet or dry seasons. During periods of drouth, the best crops have always come from tiled lands.

Land that is baked and hard is especially susceptible to improvement by artificial drainage. Properly tiled land can be worked at least ten days earlier with greater ease and will yield as much as fifty per cent more crop.

It is never necessary to dig up and relay the courses if only first class tile is used. Tile draining is a permanent improvement, as much so as a barn or a dwelling and will pay big dividends if well planned and well laid.

There are many additional advantages to be gained by removing the water downward through the soil instead of over the surface. Among them may be mentioned:

Manure or other fertilizer percolates downward and thoroughly saturates the soil.

The frost leaves the soil earlier in the spring and you can plant one or two weeks earlier than in soils with surface drainage only.

The growing plants are constantly fed by the rain water which dissolves and prepares the crude soil material, adding important chemicals needed by all vegetable plants.

Caution

If there are trees near the tile, destroy them. Willow roots will destroy tile 75 feet from the tree. All water-loving trees and grapevines are dangerous to tile. It is also good economy to protect the outlet against possible obstructions.

Vitrified Drain Tile

Round Drain Tile

Hexagon Drain Tile

GOOD tile, when properly formed and burned, will last indefinitely. It should be made of a good grade of stoneware clay or shale. It is not necessary that the tile be porous, as the water enters the drain through the joints. The actual amount of water that will pass through the walls of a well-burned tile is negligible. Drain tile has a carrying capacity of more than double that of open ditches.

In preparing a table to ascertain the requisite size of pipe to be used, we take as a basis the fall of the sewer per hundred feet and the area to be drained. The number of gallons discharged per minute by the specified sizes is clearly shown. It is well to remember that in main drains, the flow is considerably augmented by the pressure of connecting laterals.

Size of Pipe Inches	GALLONS DISCHARGED PER MINUTE							
	1-Inch Fall per 100 Feet	2-Inch Fall per 100 Feet	3-Inch Fall per 100 Feet	6-Inch Fall per 100 Feet	9-Inch Fall per 100 Feet	1-Foot Fall per 100 Feet	2-Foot Fall per 100 Feet	3-Foot Fall per 100 Feet
3	9	12	15	22	27	31	44	54
4	20	28	35	50	62	71	101	124
6	63	89	111	156	194	224	317	389
8	140	198	246	348	432	499	706	864
9	196	277	339	480	595	687	971	1,180
10	261	369	457	648	803	928	1,310	1,610
12	432	612	758	1,070	1,330	1,530	2,170	2,660
15	800	1,130	1,400	1,980	2,450	2,830	4,010	4,910
18	1,320	1,860	2,310	3,260	4,440	4,660	6,590	8,080
20	1,720	2,500	3,060	4,330	5,305	6,130	8,660	10,610
24	2,910	4,110	5,035	7,191	8,810	10,270	14,520	17,790
27	4,020	5,680	6,960	9,840	12,050	13,920	19,680	24,110
30	5,380	7,618	9,320	13,180	16,140	18,640	26,350	32,280
33	6,950	9,840	12,050	17,040	20,865	24,090	34,070	41,730
36	8,800	12,450	15,210	21,565	26,410	30,500	43,130	52,820

Mortar Colors

ALTHOUGH one of the minor items of expense in building, mortar colors are a decided factor in the appearance of the finished structure. It is only through the use of colored mortar joints that the full beauty of the wonderful face brick produced today can be realized.

When it is remembered that mortar joints represent often as much as one-fourth the wall area, it is highly essential that only such colors be used as will prove absolutely permanent in shade and tone. Our colors do not contain any products of chemical manufacturing plants and are made from the richest and purest ores obtainable. They have behind them the reputation of a responsible and long established manufacturer.

The Brick Manufacturer Advises the Use of Mortar Colors

Have you ever noticed how the brick manufacturer exhibits his product? In almost every instance, his display panels will incorporate mortar colors. It brings out their full beauty—showing many unusual and tasteful combinations that change a plain brick wall into a distinct decorative unit. The brick manufacturer heartily recommends colored mortars, realizing that only by their intelligent use may the full beauty of brick be realized.

The Architect Specifies the Use of Mortar Colors

To be of real service to his client, the modern architect is very careful to specify the exact color and texture of the mortar to be used in erecting the structure. He knows that a harmonious whole cannot be obtained if so important a detail is ignored. A very plain and severe brick building becomes warm and inviting in appearance through the judicious selection of color. A more beautiful building for practically the same investment is within the reach of all.

Mortar Colors

Mortar Colors Are Permanent

A few inferior brands of mortar colors that weaken the mortar and run and fade under varying weather conditions have worked great hardship on reliable manufacturers of this product. It is therefore well to inquire into the source of manufacture before the question of price is considered.

Our brands have been standard in the United States and Canada for many years. Only the richest and purest ores are used, containing absolutely nothing that could possibly injure or weaken the mortar. We stand on record as thoroughly convinced that neither climate nor age can impair their color or strength.

Instructions for Mixing Mortar Colors

First mix the color uniformly with the sand. Then add slaked lime. The more thorough the mixing the less color is needed to produce the required shade. By adding water in advance, the colors may be made into a paste and added to the mortar. The latter method is highly recommended.

Never mix the color with hot lime. It must be thoroughly cool before using. If you cannot wait, use commercial hydrated lime.

Above all, carefully weigh or measure both the mortar and color. Results will justify it.

Quantity of Color Required for Mixing Mortar Color

To lay 1,000 brick with a ⅜" joint, the approximate amount of color necessary may be obtained from the following table:

	⅜" Joint
Mortar Brown	90 lbs.
Hematite Red	75 lbs.
Double Strength Chocolate	75 lbs.
Colonial Buff	90 lbs.
Special Chocolate	75 lbs.
Pompeiian Buff	90 lbs.
Mortar Black	125 lbs.
Double Strength Black	75 lbs.

How Our Colors Are Packed

To meet the demands of the trade, we pack our mortar colors in barrels, half-barrels, kegs and 100-lb. paper-lined cloth bags. We employ the highest type of labor and use only the best materials in our packing department.

Our colors will invariably reach you in the very best condition.

Agricultural Lime

Approved and Used by Practical Growers

LIME, a plant food unsurpassed for correcting acidity and sourness of the soil, has been used in civilized countries for more than two thousand years. As a consequence, the soil of the various European countries is just as productive and fertile today as in all the preceding years.

In our own country, the use of hydrated lime as an agricultural aid has proven remarkably successful. When we reflect that a ton of red clover removes approximately 40 pounds of lime from the soil, it will be clearly seen that lime is an important plant food and must be regularly renewed. Other crops also take a very large percentage of lime out of the ground, leaving it heavy and sterile unless the proper balance is again attained by artificial means.

Many who have not experimented to any great extent with lime as a fertilizer are under the impression that a liberal amount of this valuable element will burn up the vegetable compounds. Such is assuredly not the case. Lime simply neutralizes the acids and makes the soil alkaline. There is no caustic action whatsoever.

Lime is equally valuable in clay or in sandy soils, although its action is entirely dissimilar. In sandy soil, it binds the grains of sand together, thus aiding materially in the retainment of moisture and fertile compounds. In clay soils, however, it is equally valuable as it breaks up the structure, permitting more water to be absorbed for gradual use during the dry season. It is easy to prepare land for the crops, if it has been properly limed.

To bring the soil back to its normal productive condition, lime must be supplied in generous quantities. The normal amount used per acre is from 500 to 750 pounds.

The most successful cultivators apply this lime in the fall of the year, but it is never too late to use it. The proper application is to the surface; never plow it under.

We firmly believe that many of the reasons for crop failure, such as winter-killing, poor germination of seeds, drought, excessive moisture, insective or fungi attacks, may be offset by the correct and liberal use of agricultural lime.

METAL LATH

Because Metal Lasts

THIRTY years of successful use in the construction of all types of structures have proved beyond all question the superiority of metal lath as a fire safe and permanent backing. Yet it is decidedly economical. Metal lath will always be a better investment than any inflammable lath on the market. Both contractor and owner are thoroughly satisfied that this is true. Permanent construction builds a much better house and saves a considerable sum of money in maintenance.

The Unlimited Possibilities of Metal Lath

Metal Lath is the one plaster base that actually takes a mechanical grip on the plaster. The plaster or stucco worker forces the coating in and keys it firmly around the metal.

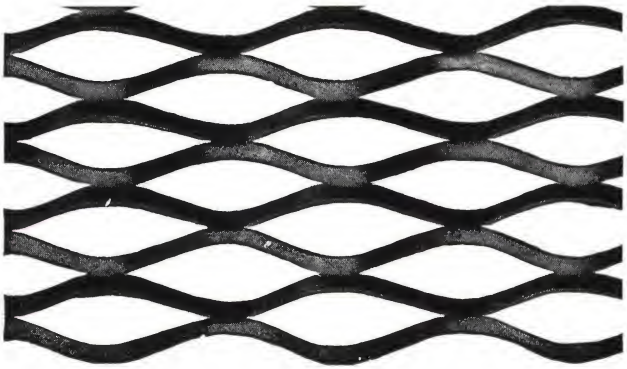
Speed of Construction. The absolute rigidity of metal lathing permits wider spacing between the supports, thus saving labor in attaching the lath and making plastering speedier. The key quickly takes hold of the plaster, yet without waste.

Convenience. The wide sheets of material are very easy to handle. It is a simple operation to wire or attach them to the supports. With a perfectly rigid surface, no sagging or swaying, the plaster takes quick hold and is very rapid.

Firesafe. Very few fires have successfully passed good metal lath construction. It is permanent in the face of the hottest fires and very seldom cracks.

Economy. There is economy at every point. Less plaster is used. The wall is quickly set up and coated. Fewer supports are needed. And the cost is very low.

Diamond Expanded Metal Lath



THE diamond-shaped mesh is the ideal metal lath construction as it gives uniform stress distribution. As the contraction and expansion of steel and concrete are identical, great strength is obtained and a perfect bond established. Metal lath makes a concrete, plaster or stucco coating absolutely permanent. There is neither rust nor erosion of metal due to the fact that the coating protects the mesh from all adverse conditions.

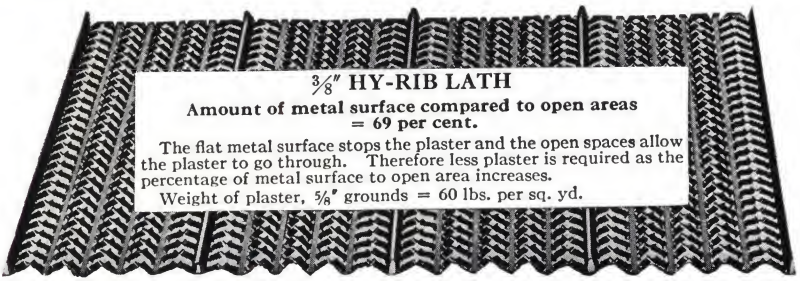
This type of mesh although adaptable to all general classes of construction is particularly useful for suspended ceilings, plaster cornices, stucco work, etc. Its adaptability is limited only by the principles of good construction.

Gauge	Weight per Square Yard, Painted	Weight per Square Yard, Galvanized
No. 27	2.33 lbs.	2.50 lbs.
No. 26	2.55 lbs.	
No. 25	3.00 lbs.	
No. 24	3.40 lbs.	3.60 lbs.
No. 22	4.20 lbs.	

Furnished in Open Hearth or Copper Bearing Steel. Painted or Galvanized before Expansion.

HY-RIB METAL LATHS

THESE types of Hy-Rib and Rib Laths are of unsurpassed stiffness and strength. They have a key which positively and securely grips the plaster. Their rigidity and their positive key assure you entire satisfaction and economy.

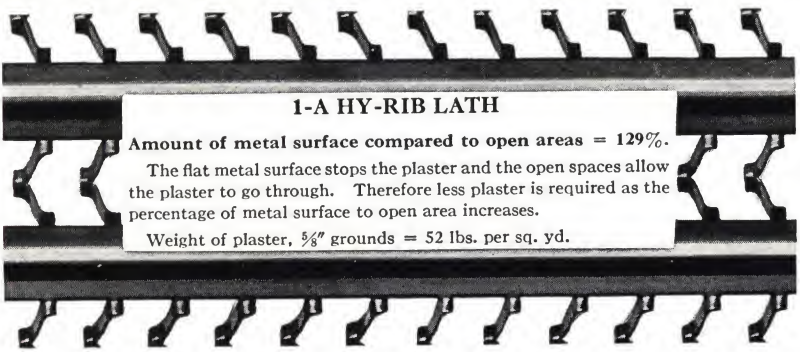


3/8" Hy-Rib Lath. Ribs 3/8 in. apart; sheets 20 in. wide. Gauges (U. S. Stand.) 24, 26 or 28—Standard lengths, 6, 8, 10 and 12 feet.

3/8" HY-RIB LATH

3/8" Hy-Rib Lath is a self-furring lath, permits wide spacing of studs and saves channels and wiring. Used generally for stucco and plaster work in ceilings, partitions, with channels, sidings, furring, etc. There is absolutely no waste in side laps.

Size of Sheets	Sheets per Bdle.	Sq. Yds. per Bdle.	Weight per Sq. Yd. 28 Ga.	26 Ga.	24 Ga.
24x72	18	24	3.0 lbs.	3.6 lbs.	4.8 lbs.
24x96	18	32	3.0 lbs.	3.6 lbs.	4.8 lbs.
24x120	18	40	3.0 lbs.	3.6 lbs.	4.8 lbs.
24x144	18	48	3.0 lbs.	3.6 lbs.	4.8 lbs.



1-A HY-RIB LATH

The most popular lath for plaster and stucco. Permits wide stud spacing and saves plaster. The most rigid surface to work against, and a perfect key for the plaster. Straight edges save 4% of the lath in the laps.

Grade	Wt. per Sq. Yd.	Stud Spacing for Walls (C. to C.)	Joist Spacing for Ceilings (C. to C.)
1-A	3.2 lbs.	16 to 28 inches	14 to 24 inches

Furnished in open hearth or copper bearing steel—all painted.
Size of sheets—18x96 inches.
Shipped in bundles containing 15 sheets or 20 yards.

Diamond Mesh Metal Lath For Reinforcing

THE contraction and expansion of Portland Cement Concrete and Steel are identical. This great truth enables you to reinforce all kinds of cement and concrete work with metal lath, thereby giving you the strength of the metal and the cement combined.

The adhesion or bond between the cement and metal is perfect, and furthermore the cement protects the metal from rust or decay.

Our concrete metal lath was designed for this purpose, and should be used in the construction of all fireproof structures for walls, floors, etc. Buildings where great strength is required and sidewalks built over basement cellars should be so reinforced.

Prices and detailed information furnished on request.

Mesh	Gauge	Size of Sheet Width Length	Sheets per Bundle	Square Feet per Bundle
½ in.	18	3 ft. x 8 ft.	Sheets	Sq. ft.
¾ "	13	6 " x 8 "	5 "	240 "
1½ "	12	4 " x 8 "	5 "	160 "
2 "	12	5 " x 8 "	5 "	200 "
3 "	16	6 " x 8 "	10 "	480 "
3 "	10	6 " x 8 "	5 "	240 "
6 "	4	5 " x 8 "	5 "	200 "
4 "	16	4½ " x 8 or 9 ft.	6 "	.....

The 3-inch mesh and 6-inch mesh can be made in 12-foot lengths if so desired.

PORTLAND CEMENT

And Its Many Uses

THE word "concrete" refers to sand and pebbles or crushed stone, or other hard material such as slag, hard cinder, broken brick, etc., which has been thoroughly mixed with Portland Cement and water and allowed to harden.

Portland Cement is the most tenacious binding material or mortar known. When properly mixed with the other materials named, it binds with a grip that makes the entire mass as hard and imperishable as if it were cut from solid stone. This "manufactured stone" has rapidly become the principal building material, where strength, durability, and protection against fire, water, rats, etc., are essential.

As concrete requires, in addition to cement, only the most commonplace and easily procured materials—sand, stone, and water—and is simply made, being merely mixed thoroughly, cast in place, and allowed to remain in forms until the hardening takes place, concrete construction has a wonderful growth. Its earliest general use was in great engineering undertakings—bridges, retaining walls, sea walls, and the like, but now that the advantages of concrete have become universally recognized, a great list of buildings and improvements, ranging from such small constructions as fence posts to the largest factories and warehouses, are being everywhere built "the everlasting way."

Why Cement is Called "Portland"

"Portland" is merely a generic name, such as "wrought" as applied to iron, or "Russia" or "sole" as applied to leather. The name was applied to this class of cement because, when Joseph Aspdin, of Leeds, England, discovered the method of making the cement, the product had a "fancied though really slight resemblance to the noted oolitic limestone from the Isle of Portland, on the South coast of England." That oolitic limestone, which by the way is used in the London Westminster Cathedral, was known as "Portland Stone"; hence it seemed natural to give the name "Portland Cement" to the new product that made stone resembling Portland Stone.

There are now almost as many different brands of Portland Cement as there are brands of flour or lime.

Increase in Use of Portland Cement

Some idea of the widespread increase in the use of Portland Cement may be gained from the fact that 8,482,000 barrels were manufactured in America in 1900, while the present yearly output is close to 100,000,000 barrels. The United States at present leads all other countries in production, and cement is produced at many different points—with raw materials that vary according to the section of the country. Clay, limestone, marl, cement rock, etc., are used.

How to Make and Use Concrete

GOOD cement is necessary to make good concrete. But Portland Cement no matter how good, can not make good concrete if mixed with sand, pebbles, broken stone or similar materials that are unsuitable.

Cement meets the severest engineering and other specification requirements, thus relieving the user of further concern in that direction.

Most of the dissatisfaction experienced in the use of concrete can be traced to improperly graded sand, or sand containing loam or sand with clay-coated particles.

Sand that can be pulverized, that soils the hands, or that smells, will not make good concrete. To test sand, stir it in a glass of water. If it settles leaving the water clear with very little sediment, it is good. A heavy sediment is an indication that the sand is of doubtful quality. The best engineering practice is to reject sand if it contains more than 5 per cent of loam.

Where strength and wearing qualities are demanded of concrete, the sand to be used should contain an excess of coarse particles. Fine sand is necessary in a mixture only in the grading of the whole bulk of sand, to reduce the volume of air spaces or voids in the mass. To be well adapted for concrete work, the greater part of the sand should remain on a 50-mesh sieve—a sieve containing 50 linear divisions to the inch or 2,500 holes to the square inch. Not more than 6 per cent should go through a 100-mesh sieve. All particles passing ¼-inch mesh are regarded as sand in concrete work. Small particles of clean stone from rock crushers, known as "screenings," if from hard durable rock, answer very well as sand. River sand averages well because usually the mud has been washed out of it. In concrete work, sand or materials used in its stead are known as "fine aggregate." Pebbles, broken stone or similar materials over ¼-inch are used in concrete are known as "coarse aggregate."

Coarse Aggregate. Usually the maximum size of aggregate, that is, pebbles or broken stone, is 1¼ or 1½ inches in diameter for most concrete work. Some concrete work such as concrete block, concrete fence posts, require a smaller maximum size; ¾-inch, for instance, is the usual maximum in fence-post manufacture, while the maximum of 1½ inches may at times be exceeded where the work is particularly massive, such as in some foundations. In very thick walls, dams, etc., large stone can be safely used provided it is clean and so placed as to be entirely surrounded by the cement and sand mixture.

No pebbles, broken stone or other similar aggregate should exceed in greater dimension, half the thickness of the section in which they are used.

Trap Rock, Granites, Gravel. Like sand, pebbles or broken stone must be free from loam, clay or similar matter. They must be hard. Concrete cannot be stronger than the materials of which it is composed. Hard granites, trap rock, hard pebbles from some gravel deposits, and slag, usually make the strongest concrete, provided the sand also has been selected with a view to uniform grading from fine to coarse and is composed of hard particles. Shale, slate, soft limestone and any material that crumbles, slivers or peels off, should be avoided. Having both the sand and the coarse aggregate of different sizes—so that the smaller particles will fit in between the larger—will reduce voids or air spaces in concrete. Elimination of voids in this way, provided the correct amount of cement is used, accomplishes water-tightness, resulting in denser, and therefore stronger concrete.

Use of Bank-Run Gravel. Natural deposits of combined sand and pebbles almost invariably contain a large excess of sand and it is true economy, as well as the best practice, to screen bank-run material and reproportion the sand and pebbles correctly.

How to Make and Use Concrete

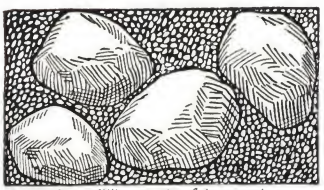


FIG. 1 Sand filling voids of large stone

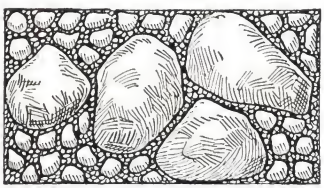


FIG. 2 Sand and small stone mixed with large

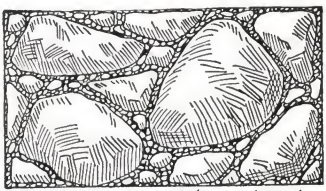


FIG. 3 Mixture of graded stone and sand.

In most gravel banks the quantity of sand—particles ranging from fine to ¼-inch size—is twice that of the pebbles, while for good concrete the proportions **should be about the reverse.** For instance, in a 1:2:4 mixture, in which the particles of sand and pebbles are uniformly graded, voids or air spaces between the particles are reduced to such an extent that the sack of cement when added will practically fill these voids and hence produce the greatest possible density; that is, the 4 cubic feet of pebbles, well graded from ¼ inch to about 1½ inches, contain air spaces which the well-graded 2 cubic feet of sand will fill, while the air spaces in the combined sand and pebbles will be filled by the cement. In fact, these proportions are such as to make a slight excess over and above that required for reducing the voids, and the concrete resulting from combining the 1 sack of cement, 2 cubic feet of sand and 4 cubic feet of pebbles will measure about 4.5 cubic feet in volume. This shows how the cement and sand have disappeared, so to speak, among the air spaces or voids in the bulk of pebbles.

If, as is often done, 6 cubic feet of material just as it comes from the gravel bank are used instead of the 2 cubic feet of sand and 4 cubic feet of pebbles, it can readily be seen that we start off in the first instance with a bulk of 6 cubic feet of material and the 1 sack of cement used would be entirely taken up in the air spaces, leaving a bulk of 6 cubic feet containing 1 sack of cement. Compare this with the other method, where the 4.5 cubic feet of concrete also contains 1 sack of cement. It requires but little thought to realize that the latter mixture must be denser and stronger on account of the greater relative proportion of cement contained.

Cinders as Aggregate. Cinders are used to some extent as a substitute for crushed stone or gravel. They are lighter and more porous than stone and less strong, but where lightness is more important than strength or where a poor conductor of heat or sound is required, they may be used. Successive floors of tall buildings are often laid with cinder concrete. Roofs are also constructed with it. Cinder concrete may be cut more easily than concrete made of stone; nails may be driven into it. The cinders used for concrete work should not contain much, if any, fine ashes. Wood ashes should not be used at all. The cinders from power plants are better than ashes from household furnaces because the intense heat of the former fuses most of the ash into hard material, leaving little or no fine matter. Where the cinders have been drenched with water as soon as drawn from the furnace, they are still better, for the reason that the fine material is washed out. Cinders are easily crushed, and it is better practice not to ram concrete in which they are used, because the breaking up of the aggregate means increasing the surface to be covered by the cement. Both slag and cinders absorb more water than pebbles or crushed stone and therefore require more wetting. As cinders have been subjected to intense heat, the material is good from a fireproof point of view.

Slag. Blast furnace slag which has been properly air-cooled and aged is suitable aggregate for concrete work. Copper, lead, or basic open-hearth slag should not be used; such materials are usually very brittle, have a glassy surface and readily cause disintegration. Slag that shows any signs of granulation has come into contact with water while hot and partial disintegration has taken place. Only slag that has been slowly cooled should be used. As there is considerable variation in the quality of slag, this material should be used with care. The best grade of slag is regarded by some engineers and builders as giving greater crushing strength

How to Make and Use Concrete

to concrete than any other form of aggregate. Slag is particularly well adapted for concrete where light weight and fire-resisting qualities are desirable, as in floors, roofs, etc.

Proportioning. Concrete is usually proportioned by volume. For extreme precision and economy on large work, it is advisable to proportion mixtures under the guidance of laboratory tests, which are made to determine the exact percentage of voids of air spaces in the volumes of sand and pebbles or broken stone used. But on most concrete work, experiments and tests have proven the following arbitrary mixtures suitable to the classes of work here designated.

Such figures as 1:2:3 indicate one part of cement—volume, not weight—to two parts of sand and three parts of the coarser aggregate.

Table of Recommended Mixtures

1:1:1 Mixture for

The wearing course of two-course floors subject to heavy trucking, such as occurs in factories, warehouses, on loading platforms, etc.

1:1:1½ Mixture for

The wearing course of two-course pavements, in which case the pebbles or crushed particles of stone are graded from ¼ to ½ inch.

1:2:3 Mixture for

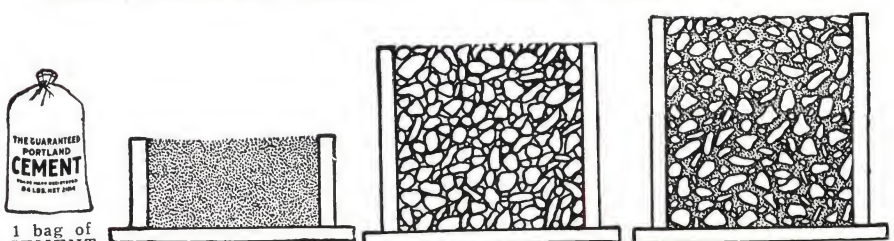
Reinforced concrete roof slabs;
One-course concrete road, street and alley pavements;
One-course walks and barnyard pavements;
One-course concrete floors;
Fence posts;
Sills and lintels without mortar surface;
Watering troughs and tanks;
Reinforced concrete columns;
Mine timbers;
Construction subjected to water pressure, such as reservoirs, swimming pools, storage tanks, cisterns, elevator pits, vats, etc.

1:2:4 Mixture for

Reinforced concrete walls, floors, beams, columns and other concrete members designed in combination with steel reinforcing;
Concrete for the arch ring of arch bridges and culverts; foundations for large engines causing heavy loading, some impact and vibration;
Concrete work in general subject to vibration;
Silo walls, grain bins, coal bins, elevators and similar structures;
Reinforced concrete sewer pipe.

1:2½:4 Mixture for

Building walls above foundation, when stucco finish will not be applied;
Walls of pits or basements, subject to considerable exposure to moisture but practically no direct water pressure;
Manure pits, dipping vats, hog wallows;
Body of concrete block;
Base of two-course pavements.



1 bag of CEMENT (about 1 cu. foot) | 2 cu. feet of SAND | 4 cu. feet of STONE | Slightly over 4 cu. feet of CONCRETE

Illustration of a 1:2:4 mix. Note that as the sand merely fills the voids of the stone and the cement fills the voids of sand, the seven cubic feet of material make a batch of only a little over 4 cubic feet of concrete. Beginners in concrete work often err in thinking that the volume of the concrete will equal the total volume of materials used.

How to Make and Use Concrete

1:2½:5 Mixture for

Walls above ground which are to stucco finish;
Base of two-course sidewalks, feeding floors, barnyard pavements and two-course plain concrete floors;
Abutments and wing walls of bridges and culverts, dams, small retaining walls;
Basement walls and foundations for ordinary conditions, where watertightness is not essential;
Foundations for small engines.

1:3:6 Mixture for

Mass concrete such as large gravity retaining walls, heavy foundations and footings.

Mortar

Cement and Sand Only

1:1½ Mixture for

Inside plastering of water tanks, silos and bin walls, where required and for facing walls below ground when necessary to afford additional protection against the entrance of moisture;
Back plastering of gravity retaining walls.

1:2 Mixture for

Scratch coat of exterior plaster (cement and stucco);
Facing blocks and similar cement products;
Wearing course of two-course walks, floors subjected to only light loads, barnyard pavements, etc.

1:2½ Mixture for

Intermediate and finish stucco coats;
Fence posts when coarse aggregate is not used.

1:3 Mixture for

Concrete block when coarse aggregate is not used;
Concrete brick;
Concrete drain tile and pipe when coarse aggregate is not used;
Ornamental products;
Mortar for masonry (when desired, lime may be added up to 15 per cent by volume of cement).

How to Figure Amounts of Materials

The first step in calculating quantities is, of course, to figure the total cubic space to be occupied by the concrete, which is learned by the simple method of reducing the dimensions to like units of measurement; for example, having all dimensions, feet or fractions of feet, and multiplying breadth and thickness together. For example, if a floor or driveway is to be 30 feet long by 12 feet wide and 6 inches thick, we have 30 by 12 by ½ equals 180 cubic feet, which divided by 27, the number of cubic feet to the yard, gives 6⅔ cubic yards of volume.

Figuring a Foundation. A foundation that is to be 1 foot thick, 10 feet high, 25 feet wide and 40 feet long would be figured as 1 by 10 by 23 equals 230 for the short wall and 1 by 10 by 40 equals 400 for the long wall. The reason for using 23 as the building length of the short wall is that if the long wall is figured the full length, its thickness will of course lessen the length of the short wall one foot at each end. As there are two short walls and two long ones, the totals of 230 and 400 would be double, giving 1,260 cubic feet, from which should be deducted space occupied by doors and windows.

Amounts of Cement, Sand and Stone. In thoroughly mixed batches of concrete about 100 cubic yards of stone will be required for a job that has a cubic volume of 100 yards. Voids vary somewhat, but usually voids in crushed stone will average about 45 per cent and the voids in gravel about 40 per cent.

The simplest rule for mixing a batch of concrete is to take the proportions as a table of cubic feet. Thus, if the proportion is 1:2:4, use four cubic feet of stone, two of sand and one of cement. As most proportions used in concrete work call for a quantity of sand that is 50 per cent, or a little more than 50 per cent of the bulk of the stone, the quantity of sand will slightly exceed the 40 or 45 per cent of voids and thus the mix for a cubic yard of cement will overrun a yard. In proportioning by volume, a sack of cement is considered as one cubic foot, and by weight, a sack of cement may be accepted as 94 pounds net.

How to Make and Use Concrete

Table 1 will be found very useful in calculating the quantities of sand and gravel, or stone, required for a one-bag batch of mortar or concrete, and in computing the volume of the resulting mortar or concrete.

It will be observed from Table 1, that the volume of finished concrete will overrun slightly when the rule is followed of using the same number of cubic yards of stone as there are cubic yards of volume in the job to be undertaken. Thus, when five yards of stone are used in a 1:2½:5 mixture the table gives the result of 5.4 yards of finished concrete. This difference comes mainly because the amount of sand used is slightly in excess of actual voids.

Example of Use of Table 1. If 100 cubic yards, or 2,700 cubic feet of space are to be filled with a 1:2½:5 mixture, 2,700 should be divided by 5.4 in order to get the multiple of 500. 500 by 1 equals 500, which is the number of cubic feet or bags of cement to be used. 500 by 2½ equals 1,250, which is the number of cubic feet of sand to be used, and 500 by 5 equals 2,500, amount of stone actually needed, no overrun being provided for.

Quantities by Weight for Differently Proportioned Concretes. The common practice is to sell sand and stone by the ton, and Table 2 gives the quantities of cement, sand, and stone required for concrete of different proportions. This is a more accurate table than No. 1, as quantities are given by weight instead of volume. Weights are given per cubic yard with the corresponding weights per cubic foot. The table is based on 45 per cent voids in the coarse aggregate.

Mixing

Proper mixing of materials, with the right amount of water, determines very largely the strength and watertightness of concrete. Too often concrete is mixed with less or with more water than is necessary.

TABLE 1

Mixtures			Materials			Vol. in Cu. Ft.	
Cement	Sand	Gravel or Stone	Cement in Sacks	Sand Cu. Ft.	Gravel or Stone Cu. Ft.	Mortar	Concrete
1	1.5	----	1	1.5	----	1.75	----
1	2.0	----	1	2.0	----	2.1	----
1	2.5	----	1	2.5	----	2.5	----
1	3.0	----	1	3.0	----	2.8	----
1	1.5	3	1	1.5	3	------	3.5
1	2.0	3	1	2.0	3	------	3.9
1	2.0	4	1	2.0	4	------	4.5
1	2.5	4	1	2.5	4	------	4.8
1	2.5	5	1	2.5	5	------	5.4
1	3.0	5	1	3.0	5	------	5.8

TABLE 2

MATERIALS REQUIRED FOR ONE CUBIC YARD OF CONCRETE

Cement by Bag; Sand and Stone by Ton of 2,000 Pounds

Proportions			Sand of Various Weights						Stone of Various Weights									
Cement	Sand	Stone	Cement Cu. Yd. 2,400 Lbs. Cu. Ft. 88.9 Lbs.	Cu. Yd. 2,500 Lbs. Cu. Ft. 92.6 Lbs.	Cu. Yd. 2,600 Lbs. Cu. Ft. 96.3 Lbs.	Cu. Yd. 2,700 Lbs. Cu. Ft. 100 Lbs.	Cu. Yd. 2,000 Lbs. Cu. Ft. 74.1 Lbs.	Cu. Yd. 2,100 Lbs. Cu. Ft. 77.7 Lbs.	Cu. Yd. 2,200 Lbs. Cu. Ft. 81.5 Lbs.	Cu. Yd. 2,300 Lbs. Cu. Ft. 85.2 Lbs.	Cu. Yd. 2,400 Lbs. Cu. Ft. 88.9 Lbs.	Cu. Yd. 2,500 Lbs. Cu. Ft. 92.6 Lbs.	Cu. Yd. 2,600 Lbs. Cu. Ft. 96.3 Lbs.	Cu. Yd. 2,700 Lbs. Cu. Ft. 100 Lbs.	Cu. Yd. 2,800 Lbs. Cu. Ft. 103.7 Lbs.	Cu. Yd. 2,900 Lbs. Cu. Ft. 107.4 Lbs.	Cu. Yd. 3,000 Lbs. Cu. Ft. 111.1 Lbs.
			Bags	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1	1½	3	7.64	.504	.525	.546	.567	.850	.892	.935	.977	1.020	1.062	1.105	1.147	1.190	1.232	1.275
1	2	3	6.96	.624	.650	.676	.702	.770	.808	.847	.885	.924	.962	1.001	1.039	1.078	1.116	1.155
1	2	4	6.04	.540	.562	.585	.607	.890	.934	.979	1.023	1.068	1.112	1.157	1.201	1.246	1.290	1.335
1	2½	4	5.56	.612	.637	.663	.688	.820	.861	.902	.943	.984	1.025	1.066	1.107	1.148	1.189	1.230
1	2	5	5.32	.468	.487	.507	.526	.980	1.029	1.078	1.127	1.176	1.225	1.274	1.323	1.372	1.421	1.470
1	2½	5	4.96	.552	.575	.598	.621	.920	.966	1.012	1.058	1.104	1.150	1.196	1.242	1.288	1.334	1.380
1	3	5	4.64	.624	.650	.676	.702	.860	.903	.946	.989	1.032	1.075	1.118	1.161	1.204	1.247	1.290
1	3	6	4.24	.564	.587	.611	.634	.940	.987	1.034	1.081	1.128	1.175	1.222	1.269	1.316	1.363	1.410

See Page 123 for Weight of Sand Gravel

How to Make and Use Concrete

Such terms as "wet," "soupy," "medium," "quaky" and "dry," while not always accurate in their description of consistency of a mixture, are nevertheless in general use. They describe in the order here named, the variations from wet to dry.

Quaky Mix. This consistency—jellylike—is preferred in a mixture for nearly all classes of general construction. Such a mixture will, when heaped into a pile, gradually flatten of its own weight, yet at no time in handling it will there be a separation between the sand-cement mortar and the pebbles or broken stone. Too much water in such a mixture would cause a separation of materials, forming pebble pockets or porous spots, resulting in a concrete of variable density when placed. Too little water, on the other hand, would prevent complete "hydration" of the cement and cause a weakened concrete mixture. "Hydration" means the chemical changes which take place in cement resulting in complete hardening. The quaky or jelly-like consistency contains about the correct amount of water to accomplish this result. Forms surrounding earth—as in the case of foundations—absorb some of the water and this should be taken into account.

Wetter Mixes. There are, however, several conditions under which one must use mixtures containing more or containing less water than described by the word "quaky." For instance, in some reinforced concrete work where the wall or section being placed is thin, it is necessary to use slightly more water so that the concrete can be well puddled around the reinforcing metal and thus be caused to adhere or bond it firmly.

Drier Mixes. Concrete block made in certain types of machines, and concrete drain pipe or tile, are good examples of cases where mixtures should contain less water than the "quaky" consistency.

In the case of drain tile and pipe, the mixtures used should contain enough water so that when the molds are removed from the product or vice versa, distinct water markings will show on the surface of the tile, thus indicating that the revolving core or packer head of the machine has been working in a concrete wet enough to cause free moisture to flush to the surface. Such a mixture can be used in any of the modern block machines.

Water. The simplest specification for mixing water is to say that it shall be good enough to drink. If this requirement is met, the water is suited for use in a concrete mixture.

Methods of Mixing

Good concrete can be made by hand mixing, but unless laborers are carefully watched and instructed as to the best way of turning materials, imperfectly mixed concrete is likely to result. Machine mixing is more dependable, especially in the batch type of mixer. These come in almost any desired capacity and are relatively low in cost. Many cement and building material dealers rent such mixers to their cement customers, and often farmers join in groups and buy power mixers that all of them can use.

Mixers of the batch type are preferable since measured materials must be put in the drum for each batch, while in the continuous type of mixers there is always possible some variation in moisture content or proportions of materials that may cause the concrete to lack uniformity.

Length of Time in Machine Mixers. Often concrete has been mixed for too short a period of time. Most mixer manufacturers recommend the number of revolutions per minute at which the drum of their machines should be revolved for best results. Whether mixed by hand or machine, mixing should continue until the concrete is of uniform color and consistency. Care should be taken when machine mixing not to revolve the mixer drum too rapidly, otherwise materials will cling to its surface, and not be tumbled about, hence will be imperfectly mixed. As a general rule, no batch of concrete which is machine mixed should be removed from the drum until mixing has continued for at least one minute and in certain types of machines, 1¼ or 1½ minutes would be better.

Working Methods in Hand Mixing. For measuring materials a bottomless box or frame of 1 or 4 cubic feet capacity should be placed on a board, filled to the

How to Make and Use Concrete

required level, and lifted off. Mixing by means of shovelfuls or wheelbarrow loads is uncertain. A frame that holds 4 cubic feet, should be marked on the inside at various levels to indicate 1, 2 and 3 cubic feet. Cement need not be measured in proportioning a mixture unless a batch requiring a smaller quantity than 1 sack is to be mixed, as 1 sack (94 pounds net) is, for convenience, considered 1 cubic foot in proportioning concrete mixtures.

Few tools are needed for mixing and placing concrete. A platform 8 by 14 feet made of tongued and grooved 1½ or 2-inch stuff so that tight joints will result, is necessary for hand mixing. A strip nailed around the outer edges on three sides will prevent the loss of cement that might be carried away when adding mixing water. Square-pointed shovels are necessary for turning the materials on the board. A sprinkling can, or hose with nozzle, a water barrel, measuring box, wheelbarrows, tampers, spading tools, a wood float, screen, steel trowel and possibly a groover and edger, are about all the tools needed.

In mixing a one-bag batch by hand in the proportions of 1:2:4, first spread out the two cubic feet of sand on the board. Distribute one bag of cement over the sand as evenly as possible. Then with shovels turn this material thoroughly, first dry and then wet, applying the water evenly. Now spread this mortar out and place the four cubic feet of stone on top. This mass should be turned repeatedly, with water being applied evenly. Note the illustration which shows the usual method of turning with the shovels. The turning process must be kept up until the mass is thoroughly mixed. It is better to err in the direction of turning the material too often than to fail to mix well enough. Streaks of cement indicate that the mixing is not thorough. It is better to keep the pile of stone wet beforehand, so it will already have absorbed some water. The method here described is not the only way by which concrete can be mixed. In fact, any method by which the various materials will be thoroughly mixed is satisfactory, but this plan has the advantage that the stone—which is the heaviest material and costs the most to shovel—is not added until the cement and sand have been into a mortar. Where bank-run gravel has about the right proportions of sand and coarse material and is to be used, spread that out on the mixing board and put the cement on top. Turn with the shovel several times dry, then sprinkle the material thoroughly and continue the turning process until the mass has been shoveled not less than four or five times. Shoveling the mixed materials into wheelbarrows will answer as one turning. A rake should not be used in mixing batches when the coarser material has been added as it draws the larger stone away from the smaller. Some use the rake to mix the cement with the sand.

All materials, tools, etc., should be placed near the mixing board, so as to reduce labor as much as possible.

Sand and cement should never be mixed long before the pebbles and water are added to complete the mixture, because all sand contains sufficient moisture to start a setting of the cement which would rob the concrete of some strength.

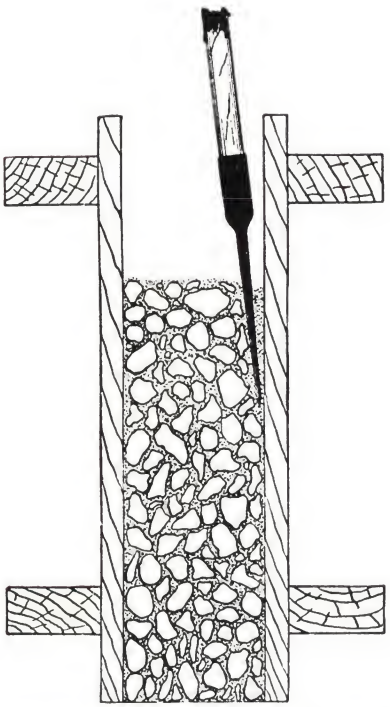
It is very necessary in mixing concrete that all of the particles of sand be thoroughly coated with a film of neat cement and water, and that the resulting mortar shall be sufficient to coat thoroughly the larger particles of broken stone so that the whole mass will be firmly bound together. Broken stone, especially some limestones, contain a great deal of fine dust. This prevents a good bond between the mortar and stone.

Placing the Concrete. Immediately after mixing the concrete should be placed. This suggests where possible to do so, the mixing platform, or the mixer, be located near the point where concrete is to be placed. This makes it convenient to shovel the concrete directly into forms.

Spading to Secure Density and Good Surface. Concrete batches are spaded into place rather than tamped. A convenient tool for spading is an old garden spade, or a hoe which has been straightened out so that the blade is in line with the handle. Special spading tools also are made with perforations in the blades which assist to bring the sand-cement mortar against form faces while holding back the coarse particles in the concrete and in this way produce a smooth surface finish when forms have been removed.

Placing Concrete in Forms

AS the hardening action resulting from the combination of cement and water begins very soon after a batch of concrete is mixed, concrete should be deposited as quickly as possible (in no case more than 30 minutes) after mixing. For convenience in placing concrete the mixing platform (if concrete is being mixed by hand) or the mixer (if machine mixing is being done) should be placed near where the concrete is to be deposited. When the concrete is placed in a trench without using forms, boards or planks should be laid along and across the trench for the workers to stand upon when dumping and tamping concrete so as to prevent knocking down earth from the sides of the trench into the freshly placed concrete.



Newly placed concrete should be thoroughly spaded to insure its entirely filling the forms

Concreting work should be planned so that the quantity of concrete that will be placed during a working day or whatever time is to be devoted to concreting can be estimated with reasonable accuracy to enable leaving the work in suitable condition for resuming concreting later. Concrete should be deposited in a layer or layers of uniform depth all around the enclosure, that is, between forms, unless it is desired to complete the work in sections to full height of forms, when a vertical joint is arranged for.

When concreting is stopped at noon or at the end of the day, clean and wash off all tools, mixer or mixing board. Shovels, spades and other tools used to mix or work the concrete must especially be thoroughly washed off with water to prevent them from becoming incrusted with hardened mortar.

Stopping Work for the Day

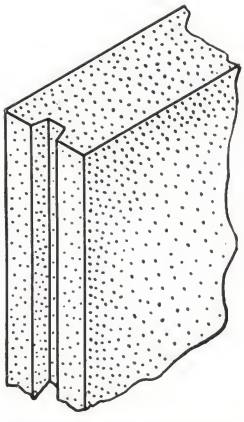
When necessary to discontinue concreting before forms are filled, as at the close of the day, the top of the concrete last placed in the form should be roughened by scratching it with a stick to prepare for a good bond with fresh concrete that is to be placed the next day or when concreting is resumed. Each day's work should be left level on top so that the joints between successive days' work will not be unsightly and also

Placing Concrete in Forms

to prevent the water running off and leaving the top dry. Immediately before resuming concreting, the surface of the old concrete should be thoroughly cleaned of all foreign substances and wet down and a thin layer of 1 to 1 mixture of cement and sand of the consistency of thick cream painted on. Care should be taken to avoid the formation of stone pockets at the beginning of a day's work, caused by the previous day's work not being left with even surface in the forms. This may be prevented by the wash mentioned above and by careful and thorough spading when the first concrete is placed on resuming work.

Protecting the Finished Work

Proper protection of concrete after placing is of utmost importance. Although a concrete mixture begins to harden within a short time after all of the materials have been combined, the complete changes which



Wall with form removed

If necessary or desirable to finish some section of concreting to the full height of the forms, a vertical joint may be provided for as shown in this illustration

result in thorough hardening take place rather slowly and are accomplished only in the presence of moisture. If concrete, after placing, is left exposed to sun and wind, much of the water which was mixed with it will evaporate, and, instead of hardening properly, the concrete will simply dry out. Many people believe that drying out is the natural process of hardening, but this is not true. Moisture is necessary for the hardening process and the finished concrete must be so protected that it will retain the water already in it until complete hardening has been accomplished. A considerable portion of the wearing qualities of concrete roads, driveways and other pavements or floors is due to the methods employed to keep them moist during the hardening period.

Forms and Reinforcement

IN order to use a concrete mixture, forms or molds are necessary so that the mass when hardened will have assumed the required shape and form. For a number of classes of concrete construction and products such, for instance, as sewers, silos, double monolithic building walls, concrete block, brick and tile, there are various types of patented forms and machines which permit quite a range of adjustments to adapt them to various dimensions of structures or products for which they are designed. Such forms or molds are almost invariably made of metal, sheet steel being the material principally used.

By far the largest part of concrete building construction is, however, done by using wooden forms; and as it is rare for any two structures to be of exactly the same dimension and detail throughout, more or less special form work has to be done for each particular job. It is possible, however, to design wood forms as unit panels, somewhat like that shown in Fig. 1, having dimensions of 2 by 4 feet or 2 by 6 feet or more, so that the forms may be used repeatedly, at least on certain parts of any square or rectangular structure.

Wood forms are often lined with galvanized iron or sheet steel to make them more durable and to assist in producing a smooth surface on the finished concrete.

Various kinds of lumber may be used for form construction. When moldings or decorative trim is to be reproduced in concrete, white pine is desirable as it may be worked easily; but white pine is rather expensive, and being soft is not very durable. Hard woods are also expensive and difficult to work. Norway pine and spruce are probably used most for form work.

Contrary to the usual practice in building construction, green lumber or lumber which is only partly air-dried will keep its shape in concrete forms for rectangular construction better than lumber that is kiln-dried. If kiln-dried lumber is used it should be thoroughly wet before concrete is placed. This is because the lumber will absorb water from the concrete, and if the forms are made tight, as they should be, the swelling from absorption will cause the forms to buckle or warp. Oiling or greasing the inside of forms before use is recommended, especially where forms are to be

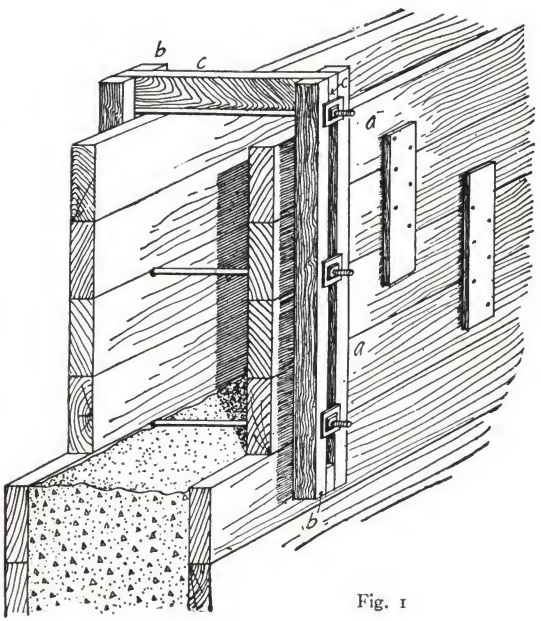


Fig. 1

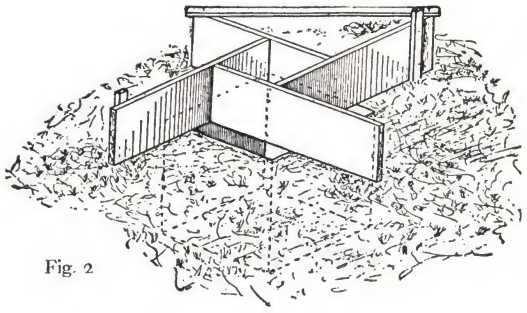


Fig. 2

used repeatedly as it prevents absorption of water and also assists in keeping them in shape when not in use.

It is often possible to build forms from stock lengths of lumber, without cutting and thereby wasting material. After use, forms so built may be carefully taken apart and the lumber can be put to other uses. A form for a column footing, for example, may sometimes be made as shown in Fig. 2 without cutting lumber.

Form lumber should be free from loose knots or other defects and irregularities that would be reproduced by the concrete. Lumber that is planed on both edges and one side is preferable, as it will give a smooth surface finish to the concrete. It is very essential that lumber for form work, where the concrete is to be exposed, be of uniform thickness, as when nailed to the studs any inequalities of thickness will result in an irregular surface on the concrete. As a rule, 1, 1½ and 2-inch lumber is most used. The added cost of dressed lumber is more than offset by the convenience in handling, working up and placing. Tongued-and-grooved lumber is often used for form sheathing, although what is known as shiplap is better. Lumber having slightly beveled edges is preferred by many because when it swells the edges will mash together enough to result in tight joints; this prevents water from leaking away and carrying cement with it.

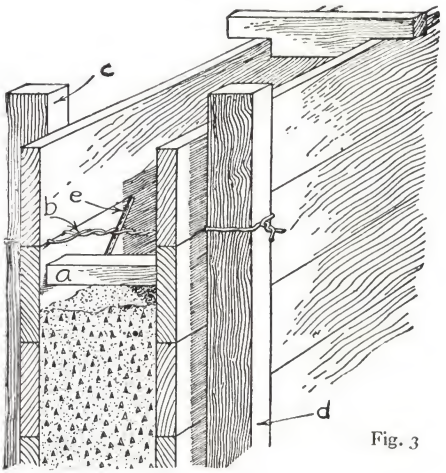


Fig. 3

Usually 2 by 4's, 2 by 6's, or in extreme cases 2 by 8's are used as form studs. The volume of concrete, or weight that must be supported determines the dimensions and spacing of form studs. Forms constructed of 2 by 4's, with one-inch sheathing, should have studs spaced not more than two feet apart, in order to prevent any bulging of the sheathing when subjected to the ramming of placing concrete, and its outward pressure until hardened.

Forms must be braced thoroughly when set up, and then held the correct distance apart by spacers, these being removed just before the concrete reaches them. Bolts or wire ties may be used to hold forms against the spacers and from spreading apart. If bolts are used they may be greased before concrete is placed so they can be driven out of the concrete easily when forms are removed. It is best to break the bond of the concrete around such bolts within 24 hours. This may be done by merely tapping them with a hammer. Wire ties are generally used and are cut when taking down forms, all of the wire, except the projecting ends, being left in the concrete. Fig. 3 shows how the forms are tightened against spacers by twisting the wire ties.

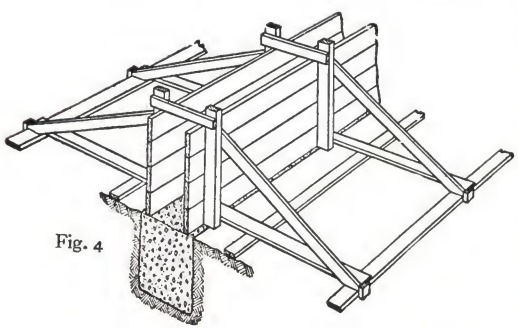


Fig. 4

When a concrete foundation is not to enclose a cellar or basement, it will often be found that the soil is sufficiently self-sustaining to permit depositing concrete in the foundation trench without forms, as in Fig. 4. For all work above ground, however, forms are required; these may be of various types as illustrated in Figs. 4, 5, 6, and 7. Fig. 5 shows a form such as would be used where the earth is self-sustaining and a smooth face on the concrete is necessary

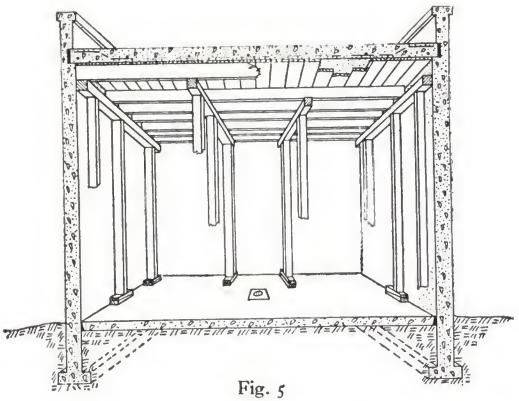


Fig. 5

only on the inside, as for a cellar wall.

As many foundations are provided with a footing, this may sometimes be constructed by omitting to nail sheathing boards on the lower eight or ten inches of the form studs as resting in the foundation trench, thus allowing the first concrete deposited to spread out and form the footing.

As concrete weighs from 130 to 150 pounds per cubic foot, floor and roof forms particularly must be designed with a sufficient factor of safety to prevent them from sagging from their own weight as well as that of the concrete. Any

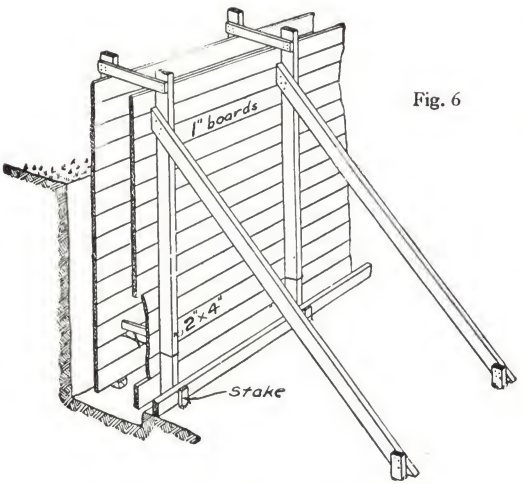


Fig. 6

sagging of forms will result in small cracks developing while the concrete is hardening, and these will gradually widen, preventing the construction from having the desired strength. Enough braces, struts, and studs must be used to prevent forms from sagging. Various methods of bracing are shown in the illustrations.

Forms should be designed with every regard for economy of lumber, and when assembling them as few nails as possible should be used. In some cases screws and clamps used instead of nails will permit removing forms with the least hammering and least injury to the fresh concrete.

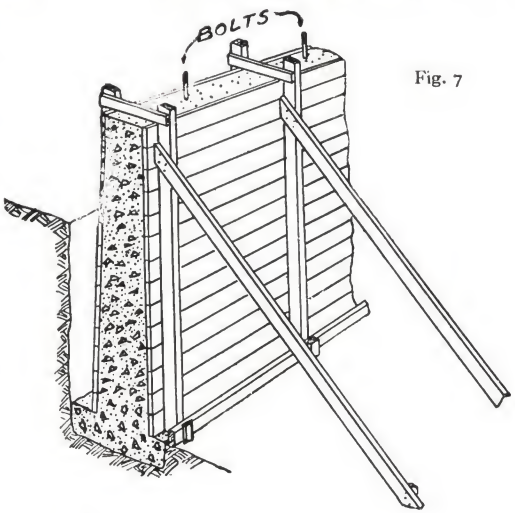


Fig. 7

Reinforcing Concrete and Materials to Use

REINFORCING is the name given to the practice of embedding steel in concrete, to increase its strength against tension, or forces that tend to pull it apart. Concrete, like many building stones, is strong in compression; that is, in bearing loads which are placed directly upon it, but is relatively weak in tension; that is, in resisting forces which tend to pull it apart.

The materials usually employed to reinforce concrete are steel rods of various forms, and woven mesh fabric similar to some of the common types of wire fencing. The reason for this is that specification requirements governing the practice of reinforcing concrete call for steel that possesses certain chemical and other qualities. Perhaps by far the commonest kind of reinforcing used is plain round or square or twisted square bars.

There are several types of so-called deformed bars to be had, many of which are patented, and therefore including in their price, royalty for the patentee. Deformed bars give a better mechanical bond between steel and concrete. However, in common types of construction, the *other types of bars will answer when used with a quaky concrete* mixture.

While it is possible to use old barbed wire and other waste materials to reinforce concrete, there are many difficulties and uncertainties attending their use. This is particularly true of barbed wire. The material is very difficult to place and to keep in proper place while depositing concrete, and unless reinforcing is placed and held in correct position while concrete is being deposited, a great deal of its possible effectiveness is lost.

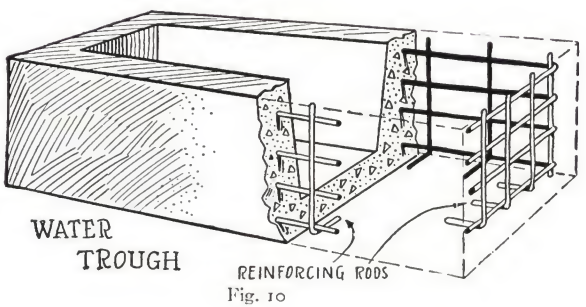


Fig. 10

If wires are to be substituted for the steel rods recommended, then one should be certain that the quantity of wires used equals in cross-sectional area the amount of rods for which substituted. The same holds true of using mesh fabric in place of rods. Mesh fabric is generally used instead of rods for floor, roof and pavement reinforcing.

On concrete work that has been the subject of engineering design only one general grade of reinforcing steel is considered. This can be obtained from any of the steel companies or through local building materials dealers.

Without going into details as to the physical and chemical properties of steel, it is sufficient to say that steel varies greatly in character; some is very much like wrought iron, while some may be compared to cast

iron. In other words, one kind stretches and bends easily while the other is stiff and brittle. This should lead one to realize that not all steel is equally well suited for reinforcing concrete.

Regardless of whether plain round or square, twisted-square or deformed bars are used, the steel should meet what are known as the "Standard Specifications for Steel Reinforcing Bars," of the American Society for Testing Materials. Practically all of the steel companies manufacture reinforcing steel that meets these specifications.

In estimating for reinforcing steel it is best to increase the estimate by 10 per cent. over the actual amount calculated for, to cover shortage resulting from cutting.

The cost of steel in place exclusive of profit on a job is generally figured at a price varying from 3 to 4 cents per pound.

Reinforcing steel not only strengthens concrete against tension but in many cases makes possible the attainment of a required strength in a structure with considerable economy of concrete. It also serves to prevent cracks that may otherwise result from expansion and contraction under temperature changes. The principal reason for using steel instead of other metals is that the ratio of expansion of steel under temperature changes is so nearly like that of concrete that the two expand in a practically equal degree; therefore, there is no "breaking of bond" between the concrete and steel.

Reinforcing is particularly necessary in tanks or troughs, where freezing is likely to increase pressure. Foundations rarely need reinforcing. Building walls above ground usually do.

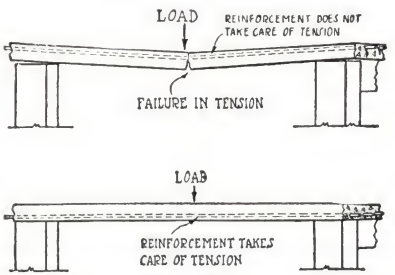


Fig. 13

The subject of reinforced concrete is a technical one and cannot be touched upon from the standpoint of design. Reinforcing for any structure should not be chosen by guess, although it is possible to specify in an offhand way safe practice for small structures such as the usual barnyard watering tanks or troughs, feeding-troughs, etc. Usually ¼-inch or ⅜-inch rods are used in tanks that are not greater than 2 by 8 feet inside dimensions, and are spaced from 6 to 12 inches center to center, both vertically and horizontally throughout the structure.

In reinforcing concrete the quantity of steel required in a structure may vary from ½ to perhaps 1½ per cent. of the cross-sectional area of the concrete. Columns and beams under excessive loads require as much as 4 per cent. or more of steel. These figures are of course only general and may vary considerably in individual cases.

Steel used for concrete reinforcement should be free from rust in the form of loose scale that would prevent the concrete from bonding properly with it. To be safe it should be brushed with a wire brush. Sometimes it is necessary to put the metal in a pickling bath, usually made by combining one part of sulphuric acid and five or six parts of water, and left there long enough to remove the rust. The rods should be thoroughly washed in clean water to prevent any further action on the steel.

There are a number of patented types of deformed sheet metal marketed under various proprietary names used particularly in floor, roof-slab and partition construction, which in some cases serve as forms as well as reinforcing.

Before depositing concrete all reinforcing rods should be fixed in proper position so they will not become displaced while placing concrete. This is particularly im-

portant for construction that must be fire-safe, since it is necessary that the metal have the benefit of a certain amount of concrete covering, not only to prevent the steel from being exposed but to insure effective bond. Reinforcing rods in such a structure as a tank, a silo or a cistern, for instance, should be wired together where verticals and horizontals cross.

In splicing reinforcing it should be lapped from 50 to 60 times its diameter. This method of joining is more effective as a rule than bending ends and hooking them together, since there is certain to be some slack where rods are so hooked, and if a strain is brought upon the concrete at such a place in the structure then the reinforcing is not effective in resisting tension. A ¼-inch rod should, therefore, be lapped with the rod which it joins not less than 12 and preferably 15 inches. Rods should be bound firmly together with wire wound around the lap. Patented "collar" clamps are also used. All rods used in beams and in floor and roof slabs should have the ends turned to an L-shaped loop or hook to form an anchor in the concrete. There should be at least 1 inch of concrete between the rods and the forms and never less than 2 inches between parallel rods.

When bending rods, bends should be made slowly. Force applied to the cold bar suddenly is quite likely to break it at the point of bending. Examine all bends and angles after made for cracks so as to detect any imperfections before placing the steel in the concrete. Reinforcing rods that are left projecting out of newly deposited concrete for the purpose of splicing other rods to them when work may be resumed should be protected against being struck or jarred, thus breaking the bond between the steel and the concrete. Reinforced concrete failures have resulted from the metal becoming misplaced while placing concrete. It is, therefore, essential that steel be placed exactly as called for in the plans.

Repairing Foundations. A frequent cause of expense with frame structures is the necessity for repairing foundations because of failure of masonry or the rotting of sills and posts. Such repairs can be made of concrete so that the work once done is done forever. To do work of this character it is usually necessary to jack up the building slightly. Rotted portions of posts are sawed off, then a form is built so that the concrete when smoothed off will almost touch the end of the sawed-off posts and after the concrete has hardened the jacks can be lowered and the building allowed to rest on the concrete piers. (See illustration above.)

Concrete Work in Cold Weather

CONTRACTORS realize that ability to lengthen their concrete building season means the profit that comes from holding together their trained organization and satisfying their men with desirable employment throughout the year rather than through only a portion of it. Overhead expenses are thus distributed over a longer period and working seasons also profitably lengthened.

Builders and owners appreciate the advantages of being able to finish a building started late in the season even though the conclusion of the work may extend into the winter months, or they are glad to know that construction may be started on their proposed building in the fall and continued throughout the winter. Either of these possibilities means earlier occupancy and consequently earlier operation with the resulting profits therefrom.

When it is remembered that concrete hardens most rapidly and uniformly in the presence of warmth and moisture, it is evident that the most important requirement for concrete work done in cold weather is that summer working conditions be developed as far as possible. In other words, the concrete must be kept warm until early hardening is far enough advanced to prevent injury from freezing. To accomplish this, sand and pebbles or broken stone and mixing water are heated so that the concrete will be of a certain temperature when placed in the forms. To insure that this warmth, given the concrete by heating materials, will not be lost until early hardening has well advanced, the concrete is protected by one or more of several means. The nature and duration of this protection depend upon prevailing temperatures and on the character and magnitude of the work to be protected.

Hot Dawg Cement Temper

Why spend dollars in over-time when a few cents worth of Hot Dawg Cement Temper will enable you to finish the job before quitting time? Why put up with the uncertainties characteristic of Portland Cement—when Hot Dawg Cement Temper can help you regulate your work so that the cement will not set too slow or dry too fast.

Hot Dawg Cement Temper insures strong, hard floors—saves labor—increases strength—protects cement from freezing and avoids checking.

Concrete Garages

PRIMARILY, the garage is a building intended to shelter the automobile. In the early days of the automobile, and, in fact, until quite recently, the owner was satisfied to house his car in nearly anything that had a roof. Old stables, sheds and other crude shelters were enlisted to serve as garages. But now the owner of an automobile demands more than a mere housing. He aims to have a building that is distinctive in design, fireproof, durable and equipped to make the necessary work on the automobile easier.

A great deal of credit is due American architects for the rapid development to its present high standard of garage construction.

The design of a garage is generally influenced by the architectural treatment of the house and other buildings in the immediate neighborhood. A garage may be attractive and well constructed, but if the architectural treatment does not harmonize with that of adjacent buildings, the general effect is displeasing. Even where a house is old-fashioned, it is well to let some feature of its design predominate in the new garage. However, the style of the garage is a matter that may safely be left to the discretion of the architect.

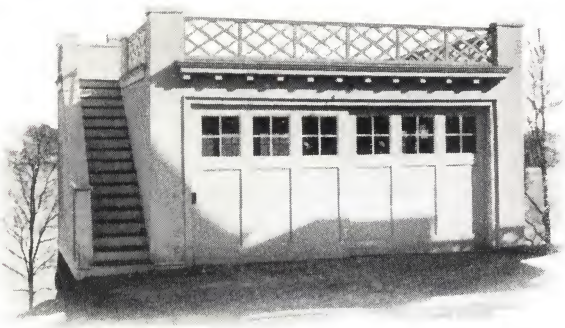
The logical location for the garage is at the rear of the house. This is a point, however, that can be discussed only generally, as the individual requirements may make it necessary to have the garage elsewhere on the property. Considerable thought should be given to the selection of the site, and the choice should be influenced by the idea of convenience and accessibility from the road or street.

In deciding upon the size of the garage, future possible requirements should be anticipated. Many automobile owners have made the mistake of building to meet only their present needs, and when a few years later they have decided to have a larger car or two cars instead of one, they have found it necessary to make expensive alterations. Even where it is fairly certain that there will never be more than one automobile, it is often a good idea to make accommodations for two. There is then room for visitors' automobiles, or, if it is desired, half of the garage may be rented to a neighbor.

It is most important that the garage be absolutely fireproof. No inflammable building materials should be used. The fact that modern garages everywhere are built of concrete is a strong indication that architects and builders recognize this material as the proper one for garage construction.

The many advantages of concrete over other building materials for garages are obvious. It has demonstrated its fireproof qualities in hundreds of notable instances. Insurance companies give lower rates on property protected by concrete. A concrete garage is easily and cheaply built, is permanently attractive, and is everlasting. It is dry at all times—and is warm in winter and cool in summer. It is clean and easy to keep clean. It is economical because it eliminates the necessity of painting and repairs and lasts practically forever.

The illustrations on following page show some pleasing effects in garage construction secured by the use of concrete.



"Concrete for Permanence." Yes, not only in erecting residence or business structures but for the private garage. Concrete gives a quickly constructed, safe and sightly structure. The views herewith give evidence of its general desirability for this type of building.

Garages, more so than any part of a home-building scheme, deserve the utmost consideration in respect to fire-protection. This factor is ever paramount, yet attractiveness is equally desirable. Concrete gives both, plus economy!

Imported Caen Stone Cement

THE natural Caen Stone, which is found and quarried in France only, has a texture and color-tone so pleasing to the eye that it has met with general approval for mantels, walls of staircases, entrance halls, vestibules, etc.

It has been used for centuries in all artistic constructions in Europe.

Its decorative possibilities are unequalled, but its high cost has made its use prohibitive.

There is a general demand for a substitute, but no natural stone has been found which even approaches it in color and texture.

Our Caen Stone Cement gives the same appearance, color and texture as the natural Caen Stone.

Our Caen Stone Cement is made in France with natural stone crushed and mixed with a special cement and chemicals.

The comparatively low cost of this material and the great facility with which it can be worked make it available for general use.

Our cement is being imported regularly from France and we are prepared to make prompt deliveries of material as follows:—

To set in 50 to 60 minutes for coating interior decorative work.

To set in 15 to 20 minutes for casting in moulds (to be worked exactly like plaster).

One ton (2,000 lbs.) properly applied will cover 60 to 80 sq. yards.

Various domestic compositions are offered as substitutes for imported Caen Stone Cement, but the uncertainty of their set, the non-uniformity of their color, and their tendency to crack, have deprived them of the consideration of experienced architects.

Brick Layers' Cement

FOR BRICK AND TILE MORTAR

BRICK LAYERS is neither a Portland nor a natural cement, but is in a class of its own, and is used exclusively for brick and tile mortar. It is made from stone in which lime and cement are chemically combined in right proportions to produce, when burned and ground, a plastic, smooth-working cement unequaled for brick mortar. The lime in Brick Layers is an ingredient in the stone from which it is made. No lime is added to it in the process of manufacture, nor is it necessary to add any lime to it in the mortar box to improve its own smooth-working quality.

A wall laid up in Brick Layers mortar is of uniform strength and durability—the bond becoming as hard as paving brick.

Brick Layers has filled the demand for a cement that could be successfully used for brick mortar without the necessity of mixing any lime with it to improve its working properties under the trowel.

Brick Layers actually costs less than a poor composition of Portland cement and lime, while in strength and durability it is unsurpassed by the best possible mixture of those materials. Brick Layers is a great labor-saver to the contractor in preparing the mortar for use. It saves him the labor of slaking lime, and the additional labor of mixing the lime with cement.

Freezing in the wall does not affect the strength and durability of Brick Layers mortar. In thousands of cases the brick work has been done in zero weather.

Brick Layers cement has been used in connection with the very largest and most important brick construction in the United States. It has been adopted continuously for many years by leading architects, engineers and contractors.

Waterproofing of Concrete

With Integral Waterproofing Paste

THE porosity of any particular material is directly in proportion to the space left unoccupied by the evaporation of an original incompressible constituent.

The amount of water used in mixing concrete or cement mortar is considerably in excess of that required for the chemical hardening and setting. This excess of water is quite necessary to provide for the proper placing and densifying of the concrete or mortar. This water is incompressible and occupies a very definite volume. Upon its evaporation, the space which it originally filled is left empty in the form of capillary pores. It is exactly these pores which give to concrete its characteristic quality of absorbing moisture and permitting the penetration of water through its mass.

With the understanding that the absorption and permeability of concrete is due entirely to its characteristic capillary structure, it is quite evident that for the correction of these qualities, it is essential to introduce integrally, a material which through its own properties will serve to effectively correct the natural inherent capillarity of the concrete. It is obvious that any material introduced into concrete or an integral waterproofing to be effective must possess in itself certain definite properties that operate to overcome the natural capillarity of the concrete.

Sufficient Waterproofing Material Cannot be Introduced to Fill Out Entirely the Capillary Space

The first conception of the properties of an efficient integral waterproofing would be a material that would possess the property of filling out and occupying the full volume left empty by the evaporation of the water. A little consideration, however, will quite clearly indicate that it is simply a physical impossibility to introduce a material integrally that will, in itself, supply enough mass to thoroughly fill out all the space left unoccupied by the evaporation of the original water. Any material that is introduced integrally with the concrete cannot, within itself, possess properties that will insure a development or increase in mass so as to automatically fill out all of the volume left in the concrete after the water has evaporated. The waterproofing material must possess properties that will enable it to prevent the absorption or penetration of moisture although it may not entirely or fully fill out the capillary space. It must be capable of producing a condition in the concrete which while it may not be fully 100% density, yet due to the very distinctive character of the integral waterproofing, will produce a condition that is equivalent to a result of a treatment whereby the full unoccupied space would be entirely filled. The conception of the solution of this condition most readily follows from the simplest application of the laws of physical capillarity.

Coating the Capillaries With Material Repellent to Water Changes Their Absorbent Qualities to a Negative Repellency

If the capillaries in the concrete can be coated or partially filled with a material that is repellent to water, then the natural absorbent qualities of the concrete will be changed to a negative repellency and the natural capillarity will no longer be expressed.

The exact condition can be very well illustrated by comparing the behavior of small capillary tubes in some of which the interiors have been treated with a lining of material that in itself is repellent to water. When the tubes without the repellent lining are placed in water they instantly express the natural capillarity and the water is positively drawn into the tube. With the tubes that have been given a repellent lining, the law of capillarity is destroyed, and instead of the water entering the tube at all, it is repelled and the action is definitely negative. Similarly with concrete, it is the natural characteristic of the pores to express their capillarity, and when coming in contact with water it is drawn and absorbed into the mass. If, however, an integral waterproofing is introduced into the mass which possesses within itself the property of repelling water, then with this repellent integral waterproofing distributed uniformly throughout the mass and coating and lining the pores of the concrete, then instead of expressing normal capillarity, the concrete throughout the mass will be negative to water, repelling it and preventing its entrance even under high hydrostatic pressure.

An Effective Integral Waterproofing Must Also Reduce the Surface Tension of Water

A third and valuable property of a thoroughly efficient integral waterproofing is the capacity of the material for reducing the surface tension of the water. This property provides a greater density by making the concrete more compact. The skin strength of the water has a natural tendency to hold the particles of aggregate apart. An integral waterproofing, to get the best results, should have the quality of cutting through the skin strength, causing the particles of aggregate to come close together. The advantage of reducing the surface tension of the water to provide for a closer compacting of the aggregate can be well illustrated by the demonstration of washing dirt from the hands without the use of soap. In the absence of soap, the water fails to remove the dirt and simply appears to form in small particles drawn into a spherical or semi-spherical form by the surface tension or skin strength of the water. As soon as soap is applied, the surface tension is greatly reduced and the water forms a continuous film over the hands and permits the easy disbursion and removal of dirt. Similarly, a product having the quality of reducing the skin strength allows all the particles to freely flow together and form a larger percentage of mass per unit volume, which is synonymous with maximum density.

Waterproofing Paste

CONCRETE is naturally porous. The amount of water used in mixing concrete or cement mortar is far in excess of that required for the chemical hardening and setting. Upon the evaporation of this excess water, the space which it formerly occupied is left empty in the form of capillary pores. It is these pores which allow for the absorption and penetration of water and moisture and give rise to the destructive and disintegrating action which such absorbed water naturally causes. The porosity, however, can be very easily overcome through waterproofing the concrete with Waterproofing Paste.

Waterproofing Paste is an integral waterproofing compound in paste form. It is added simply and directly to the water used in mixing concrete or cement mortar, and through its use the concrete is made absolutely impermeable.

Waterproofing Paste possesses all of the requisites of a perfect waterproofing compound. It mixes readily with the water, its effect is permanent, and it is of such a chemical composition that the strength of the finished structure is not lessened.

Waterproofing Powder

is identical with the paste in resulting composition and waterproofing effect. The sole difference between the two is the greater ease and convenience of mixing which the paste form offers. In consequence of this, perfect waterproofing effect is more certainly obtained with the paste than with the powder, although if the mixing of the powder with the cement is thoroughly and carefully done, equally good results can be obtained with either form.

Package

Waterproofing Paste is shipped in square cans, with large friction seal, of 1 gallon (8 lbs.) and 5 gallons (40 lbs.) each. These are packed for shipment in substantial crates of 6 one-gallon or 2 five-gallon cans each.

Price

The price of Waterproofing Paste is substantially the same as that of the powder. It contains, also, the same percentage of combined fatty acids and is therefore equal to the powder in waterproofing effect. Prices, delivered at any freight or express station in the United States, quoted on application.

Specifications for Use of Waterproofing Paste

APPROXIMATE quantities needed for 100 square feet of cement work in thickness as shown below. Table No. 1 and No. 2 are for MASS CONCRETE and Table No. 3 is for top coat and also for plaster coat in waterproofing.

TABLE NO. 1

Mix	Thickness	Cement Sacks	Sand Cwt.	Gravel Cwt.	Requires Paste 1-36 Mix	1-24 Mix	1-18 Mix	Requires Water Avg. Gal.
1 part Cement	3″	5.55	11.10	23.02	2.1	3.15	4.2	9
2 part Sand	4″	7.4	14.80	30.68	2.8	4.2	5.6	12
4 part Gravel	5″	9.25	18.50	38.36	3.5	5.25	.7	15
	6″	11.1	22.19	46.03	4.2	6.3	8.4	18
	7″	12.95	25.89	53.70	4.9	7.35	9.8	21
	8″	14.8	29.59	61.38	5.6	8.4	11.2	24
	9″	16.65	33.29	69.05	6.3	9.45	12.6	27
	10″	18.5	36.99	76.72	7.0	1.05	.14	30
	12″	22.2	44.38	92.06	8.4	12.6	16.8	36

TABLE NO. 2

Mix								
1 part Cement	3″	4.62	11.58	24.02	2.1	3.15	4.2	9
2½ part Sand	4″	6.16	15.44	32.02	2.8	4.2	5.6	12
5 part Gravel	5″	7.7	19.31	40.04	3.5	5.25	7.0	15
	6″	9.24	23.17	48.05	4.2	6.3	8.4	18
	7″	10.78	27.03	56.06	4.9	7.35	9.8	21
	8″	12.32	30.89	64.06	5.6	8.4	11.2	24
	9″	13.86	34.75	72.07	6.3	9.45	12.6	27
	10″	15.4	38.61	80.08	7.0	10.5	14.0	30
	12″	18.48	46.33	96.10	8.4	12.6	16.8	36

TABLE NO. 3

FINISH OR PLASTER COAT

Mix								
1 part Cement	¼″	.985	1.96	.....	....	.....	2 lbs.	4¼
2 part Sand	½″	1.97	3.94	.....	....	.....	4 lbs.	8½
	¾″	2.955	5.93	.....	....	.....	6 lbs.	12¾
	1 ″	3.94	7.88	.....	....	.....	8 lbs.	17
	2 ″	7.88	15.77	.....	....	.....	16 lbs.	34
	3 ″	11.82	23.65	.....	....	.....	24 lbs.	51
	4 ″	15.76	31.54	.....	....	.....	32 lbs.	68

Note: Cement is figured in bags; decimals indicating a fraction over. Sand is figured in cwt. (100) and decimal is that part over cwt., or it can be read by omitting decimal and then will read pounds. Gravel can be computed in the same manner. Waterproofing Paste weighs 8 lbs. to a gallon and figures shown are in pounds and fractions thereof.

Miscellaneous Uses

OUR WATERPROOFED CEMENT is especially suitable for exterior or interior stucco or plaster finishes, basement walls and floors, concrete storage tanks for oil, brine, or liquids containing acids, cisterns, reservoirs, swimming pools, concrete conduits, sewer pipe, standpipes, troughs, elevator pits, tunnels, cement roofs, subways, dams, concrete blocks, concrete work on the farm, and a multitude of other uses in which resistance to percolation of water is required.

Specifications

(All proportions mentioned are by volume)

Stucco on Metal Lath

FIRST COAT:
1 part gray Portland cement.
2½ parts clean, sharp sand.

This coat should have a minimum thickness over the lath at any point of not less than ¼ inch, making a total thickness of from ½ to ¾ inch.

SECOND COAT:
1 part Waterproofed Cement.
2 parts clean, sharp sand. (To be ½ inch thick.)

THIRD COAT:
If rough cast or stipple finish is desired, use same mix as for second coat, ¼ inch thick.

Stucco on Brick, Stone, Hollow Tile, Etc.

FIRST COAT:
1 part gray Portland cement.
2½ parts clean, sharp sand. (To be ⅜ inch thick.)

SECOND COAT:
1 part Waterproofed Cement.
2 parts clean, sharp sand. (To be ½ inch thick.)

THIRD COAT:
If rough cast or stipple finish is desired, make second coat ⅜ inch thick, use same mix as for second coat, and make finish coat ¼ inch thick.

Plaster for Foundations, Walls, Floors, Etc.

1 part Waterproofed Cement.
1½ parts clean, sharp sand.

Mortar for Laying Up Brick, Stone, Etc.

1 part Waterproofed Cement.
3 parts clean, sharp sand.

Reinforced or Mass Concrete

1 part Waterproofed Cement.
2 parts clean sand.
4 parts broken stone or gravel.

Note.—If it is desired that the mortar be especially plastic, hydrated lime to the amount of not more than 10% of the weight of cement used may be mixed dry with the cement. The resulting mixture will work easier under the trowel.

Work must be thoroughly wetted to prevent absorption of water from the fresh plaster coat.

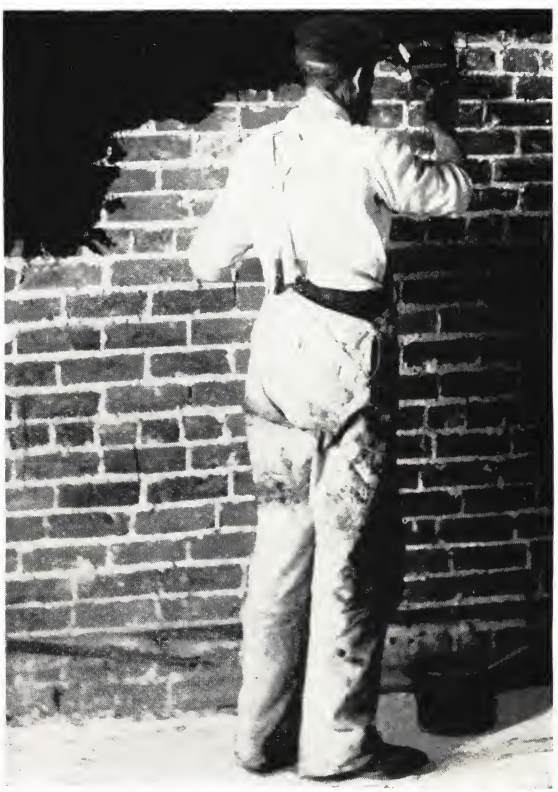
Plaster Bond

THIS product is a special bituminous coating for dampproofing all exposed walls. Its use provides a continuous dampproofing element in all such walls, which perfectly insulates the interior from any evidence of dampness. On application to the surface it is partially absorbed into the pores, thoroughly sealing them and establishing a most inseparable bond.

The presence of the bituminous coating deeply deposited in the pores, affords a positive and efficient bar against the continuous penetration of any moisture absorbed from the exterior exposed surface.

Plaster Bond is so formulated as to indefinitely remain flexible and tacky after being applied to the wall, and will furnish a tenacious and permanent bond to a scratch coat of plaster trowelled directly on it. This property of Plaster Bond obviously serves the excellent and economical purpose of eliminating the necessity of furring and lathing, thereby increasing the cubic area of available space and overcoming the disagreeable features associated with such an air space. The continuous coating of Plaster Bond on the interior of an exposed wall contributes a fair degree of insulation, which, although not equivalent to an air space, yet for a great number of applications, is sufficient.

It is to be emphasized that the prime function of Plaster Bond is to provide a continuous dampproof coating on all exposed walls, and its special feature of holding a coat of plaster applied directly to it is a useful but distinctly secondary consideration to its dampproofing efficiency. As this product is fundamentally a dampproof coating, it is only recommended for treating the interior of exposed vertical walls. It may be used on interior partitions for its bonding capacity, but we do not generally recommend it for use on ceilings and similar surfaces on a horizontal plane.



Plaster Bond is applicable to any masonry surface and should correctly be applied only to a dry surface, so as to insure the proper absorption and penetration into the wall. As continuity is absolutely necessary for satisfactory results from Plaster Bond, special care should be taken to insure a continuous coating between floor levels and the ceilings below, and in cases where this is not possible, we recommend that the coating be carried back about twelve (12) inches on the ceiling before plastering.

Plaster Bond is applied with a brush similarly to paint and must present an even, uniform, black appearance before being coated with plaster. In cases where the first coat penetrates deeply into the surface, it is very necessary that a second coat be applied so that the entire area will have the most even, uniform, black appearance.

Liquid Floor Hardener

For Prevention of Dusting, Crumbling, Cement Floors

IN common with every other structural material, however, concrete under one or another condition needs some protective treatment. Particularly when used as a flooring does the need for such treatment become apparent.

No portion of a building receives such steady and severe usage as its floors. This is especially true in a factory. The constant scuffling of feet, the grind of truck wheels, the scrape of dragging crates and boxes produce an attack upon the floor surface which is almost irresistible. Concrete alone and unaided must inevitably succumb to such an attack.

Dust is Sign That Floor is Crumbling Away

The first warning that the floor is giving way and going to pieces under such traffic is "dust." Dust is a certain sign that the floor is rapidly disintegrating—that a crumbling process has set in which will shortly produce ruts, grooves and holes. And when these holes once appear the floor is past saving. A new floor becomes the only alternative.

Hardens Cement Floors—Stops Dusting and Prevents Further Disintegration

It is during this dusting stage, however, that the disintegration and crumbling process can be entirely arrested and cured by a simple protective treatment. The floor can be thoroughly hardened, in fact, such an armor-plate hardness can be imparted to it that it will be almost indefinitely preserved. Floors that are on the verge of passing utterly beyond usefulness can be made practically as good as new and their owner saved the hundreds of thousands of dollars necessary to replace them. The treatment which will do this consists merely of an application of Liquid Floor Hardener.

Hardens Cement Floors Chemically

Liquid Floor Hardener is a transparent liquid chemical for structurally hardening and wearproofing cement finished floors of all descriptions. It penetrates into the concrete floors and chemically hardens the cement.

Metallic Floor Hardener

For Hardening and Densifying Cement Floors

CEMENT FLOOR HARDENER provides a simple and economical method of producing wearproof and dustproof cement-finished floors.

This product is easily mixed with dry Portland cement and very simply dusted over a cement finish and troweled to a smooth, hard, wear-resistive surface.

The usual characteristic tendency of a cement floor to continually dust and wear away to a rough uneven surface is entirely overcome with Floor Hardener. The surface produced according to the following specifications is so smooth, hard and dense that the friction of traffic and service over the floor does not abrade the surface to form dust or granulate the finish and cause it to wear away.

Floor Hardener adds to the natural economy and fireproofness of a cement-finished floor the qualities of dustproofness and wearproofness, which alone are necessary to give the most perfect flooring material for general construction requirements.

As Floor Hardener is always used as an admixture to Portland cement the physical size of the particles of the Floor Hardener should always be considered in the relationship which they bear to the physical composition of the Portland cement, in order that the two may work together to provide the densest mixture.

Top Coat. 15% mix for ¾" top giving approximately 100 sq. ft. of floor.

45 lbs. Hardener
300 lbs. Portland Cement
600 lbs. River Sand

Cement Floor Enamel

Cement Floor Enamel produces a tough, hard, elastic and reasonably durable finish on cement floors. Affords a perfect and attractive enamel finish that stops the dusting of the floor. Protects the floor from staining, due to the absorption of oils, greases and other foreign matter. Color card on request.

Floor Primer

Cement Floor Primer to be used as a priming coat under Floor Enamel on New Work or when coating any concrete floor laid directly on the ground. Penetrates into the surface and perfectly seals the pores, thereby insulating the Enamel from contact with any alkali brought into solution by moisture.

Specification for Enameling Cement Floor

(1) The Condition of the Floor

(a) The floor to be coated shall be absolutely dry.

(b) The floor shall be swept clean of all dust and loose particles with a good stiff broom or brush, without dampening.

(c) The floor shall be practically free from all oils, greases or any similar foreign matter, that would, in any way interfere with the most perfect penetration of the Enamel into the pores of the surface.

(2) Preparation of Cement Floor Enamel

(a) The top of the packages shall be completely cut out, so as to permit the most thorough stirring and mixing of the contents.

(b) Pour the excess of liquid, from top of pigment, into a separate can, and after thoroughly stirring the pigment, return the original liquid, while constantly stirring, so as to insure the most perfect distribution of the pigment throughout the vehicle.

(c) Concrete Floor Enamel shall not be reduced with any thinner, when used from a freshly opened package on a floor of average porosity. In case the floor is exceptionally dense, the Enamel shall be very slightly thinned by the addition of a very small amount of turpentine, so as to insure proper penetration of the Enamel into the pores, necessary to obtain a satisfactory bond.

(d) In case the enamel should become thick on being allowed to stand in the open package exposed to the air, it shall be reduced to brushing consistency by the addition of a small amount of strictly pure spirits of turpentine. Very special care shall be taken to cover the package, when not being used, and avoid evaporation as far as possible, so as to eliminate the necessity of thinning.

(3) Application to the Floor

(a) All floors laid directly on the ground, or in position to absorb water directly from surrounding conditions, shall be given a liberal coat of Cement Floor Primer, before applying the Enamel. The Floor Primer shall be allowed at least 24 hours to dry and harden, before coating with Enamel.

(b) Cement Floor Enamel shall be applied directly to the dried surface with a good, stiff, solid 4-inch paint brush. Special care shall be exercised to exert enough pressure on the brush in application, so as to force the Enamel into the surface pores, permitting it to bond itself most securely and inseparably with the floor.

(c) A second coat of Enamel shall be applied after the first coat has become perfectly hard and dry, which will require at least 48 hours.

(d) The finishing coat shall be allowed at least 48 hours to become dry and hard, before use, and then should not be severely used, until it has had at least a week for more perfect hardening.

ROOFING MATERIALS

Rubber Roofing Paper, Slate and Slaters' Tools, Roofers' Supplies, Etc.

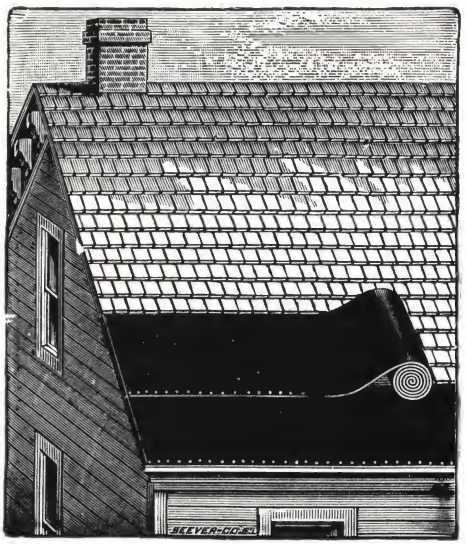
THE present-day tendency in buying roofing materials exhibits a growing preference for materials of recognized worth and known protection against the elements of fire, water and climate.

A roof must be permanent, yet not sacrifice appearance; the material must be convenient to handle and easy to apply and economical, not only in first cost but in maintenance; it must resist atmospheric conditions as well as fire; it must take stains and finishes and retain colors without quick fading; above all it should be a definite asset to the building to which it is applied not only in its protective qualities but in its beauty of appearance and its harmony with the rest of the structure.

It is a Houston policy to offer only the highest type of roofing materials and supplies, and you can order with definite assurance of complete satisfaction and prompt delivery.

This Roof of Strips Represents a 37½% Saving in Labor Costs to Its Owner—Like Every Roof of Strips

Niagara Rubber Roofing



NIAGARA RUBBER ROOFING contains natural oils that are chemically a part of the asphalt. These oils make it pliable and workable. They are not subject to evaporation—but instead they are permanent because they are a chemical part of the asphalt, and they serve to bind together the elements of which asphalt is composed. The use of such asphalt results in a good roofing.

Asphalt Coating

Genuine Asphalt Roof Coating, especially prepared for this purpose. Carried in stock in barrels and smaller packages. We recommend this for painting and repairing all high class composition roofs.

Broad Head Roofing Nails

Galvanized Broad Head Roofing Nail for composition roofs—diameter of head ½ inch. This nail is economical, because no tin caps are required. We recommend it as entirely satisfactory.

Niagara Asphalt Roof Cement

Makes Old Roofs as Good as New—Gives It Years of Watertight and Weatherproof Service

NIAGARA ASPHALT ROOF CEMENT will put a new roof on your building, for it is a tough rubber hide that will stand all weather conditions. You can make your old roof as good as new, give it years of watertight, weatherproof service, with a single, easily applied, coat of Niagara Asphalt Roof Cement.

You can lay a new roof right over the old when you apply Niagara Asphalt Roof Cement. It is a cement, not paint. Covers and seals ordinary holes and leaks. Protects roofs of tin, felt, composition, rubber and iron. Niagara Asphalt Roof Cement adheres to any surface. It requires no painting. Put it on a new roof now, and your roof will stay new for years. You will not need to be constantly painting. It gives lasting years of protection without constant expense and attention. It saves the new roof, and is absolute guarantee of future roof economy.

Niagara Asphalt Roof Cement outwears any paint. It puts on your roof a thick substantial covering that is acid-proof, proof against sun, wind, rain and weather.

Convenient and Easy to Apply

You can get it in either paste or liquid form, whichever is most convenient for you. The liquid can be applied with roof brush or mop. The paste is applied with a trowel. It can be laid to any thickness desired over the entire roof. A single coat 1/16″ in thickness is equal to 20 coats of ordinary roof paint. The paste will seal larger holes—it is used to repaint flashings — to permanently patch leaks of any kind. It's fibrous nature makes it ideal for this purpose.

Sold in barrels, one-half barrels, kegs and cans. Comes ready for instant use.

Facts About Prepared Roofing and Asphalt Shingles

THE most conservative estimates place the present daily output of this industry in the United States at approximately seven and one-half million square feet of finished material. Think what this means! Enough roofing made every day which if rolled into one sheet 3 feet wide, would stretch from Chicago to Buffalo, a distance of more than 500 miles, and be sufficient to roof 4,000 average homes. The increasing demand is rapidly forcing a greater output so that these figures will soon fall short of the mark.

Prepared Roofings Conserve Waste Products

Unlike wooden shingles, prepared roofings and asphalt shingles are made almost entirely of waste materials. It is a recognized fact that any product tremendously multiplies its economic value when, as the result of the conservation of waste materials, it provides a substitute for an article, the production and use of which constitutes a waste. The raw materials entering into the manufacture of asphalt shingles and prepared roofings can properly be called waste products, the chief conservation of which is the use of them in roofing. The basic felt is made of rags—the old clothes of the nation. The saturant and coating compounds come largely from the earth, which is seeping with them, or as a by-product of the refineries. The mineral surfacings are ground from the sawings of the slate quarries or other equally useless bits of rock. These facts are too often overlooked, but as our country becomes forced more and more in the future to interest itself in the great principle of conservation these important features will be more fully appreciated.

Prepared Roofings Are Economic Necessities

It has been stated that prepared roofings and asphalt shingles are economic necessities because they fulfill the functions of a roof covering better and at a lower cost than any competing material. Let us then consider these various roof functions and learn the manner in which asphalt shingles and prepared roofings are made and how they meet the requirements.

Fire Protection

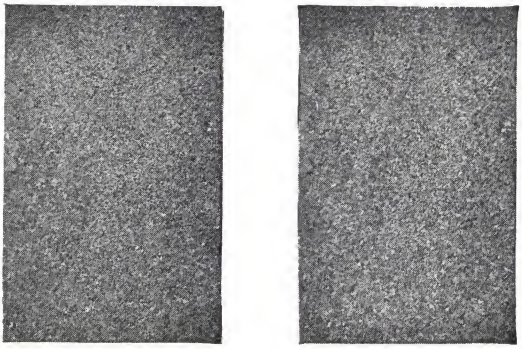
The ability of asphalt roofings to protect against fire is far greater than one might suppose in view of the fact that they can be ignited on an exposed edge with a match. It is difficult to understand how any material that will burn at all can offer a resistance to the spread of fire. The truth of the matter, however, is that when asphalt roofings are laid upon the roof in the regular manner, even though some of the waterproofing pitches can be ignited if subject to sufficient heat, they do not support their own combustion. Build a bonfire upon a roof or expose an asphalt shingle roof to the flame of a gasoline torch; the fire will not spread and the boards underneath will be protected in a most surprising fashion.

Fire Resisting

Prepared roofings in general, asphalt shingles in particular, afford an exceptionally high degree of protection to the roof boards when subjected to fire. They can be ignited and will burn briefly with a flame, in exactly the same fashion as do tar and gravel roofs or asphalt and gravel, but, like both the latter, they do not spread fire beyond a very few inches from the point of exposure. The fact that these roofings contain some waterproofing materials, which are of an inflammable nature, is of but little importance in the light of their ability to keep fire away from the roof boards for a long period.

Niagara Asphalt Shingles

Slate Covered



"The test of time has proved them serviceable, permanently good looking, fire resisting and more economical than wood"

ASPHALT SHINGLES have been in use for many years and they are now considered a standard roofing material for residences, bungalows, churches, schools and for all sloping roofs where an attractive, durable and fire-resisting roof at a moderate price is wanted.

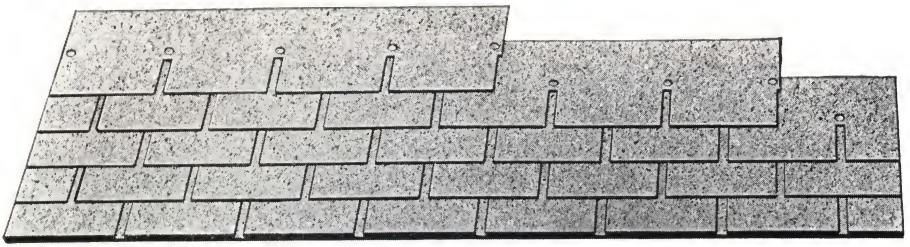
The shortcomings of wood shingles are known to everyone. The principal reason for their use by former generations is found in the fact that there was nothing to be had at a moderate price to take their place. The greatest objection to wood shingles is the fire risk. Today there is wide and ever-increasing recognition of the fact that the use of wood shingles is a menace to public safety and many of the large towns and cities and even the small towns, are prohibiting the use of wood shingles within their city limits.

For in the country or on a farm, where the fire danger seems quite remote, every day buildings with good shingle roofs catch fire from their own chimneys and burn to the ground. On the farm the risk is greater because of the little or no fire-fighting service. A more attractive, highly fire-resisting material can be used at about the same cost as wood.

What They Are Made of

Niagara Shingles are made of good quality, heavy weight felt thoroughly saturated with high-grade refined asphalts. An extra heavy asphalt coating is applied to the upper side of the felt, and while this coating is hot, we roll and compress into it an even layer of natural chipped Red, Blue Black or Green Slate, selected for its rich, permanent colors.

In the manufacture of Niagara Shingles is used a larger quantity of slate than is necessary in order to be sure that just as much slate as each shingle will hold is forced into its surface. You can see that in doing this there is bound to be a small amount of slate which does not come into contact with the coating of the shingle, and of course this surplus of slate will come off because there is nothing to hold it on. Except for this small surplus, which is not attached, the slate surfacing will not wash or flow off. It has become a part of the material.



A roof of NIAGARA STRIP SHINGLES cannot be distinguished from a roof of individual shingles

Guaranteed Durability

ASPHALT SHINGLES are made in two or three distinct grades. We make the best shingle it is possible to make. Niagara Shingles are of good quality, heavy weight felt, and the asphalt saturation and coating of this felt is heat treated to remove all volatile oils.

Do Not Affect Rain Water

Niagara Shingles are made of the most lasting asphalt known, carefully refined. They will not rot—they cannot rust. They are uninjured by gases or acid fumes. They do not warp, split or crack. The sun's heat cannot melt them. They are poor conductors of heat, keeping your house cool in summer. Your roof covered with Niagara Shingles is paved with three substantial layers of asphalt and chipped slate. There is no expense after laying. No painting is ever necessary. They will not taint, discolor or affect rain water in any way. Red cedar shingles will stain rain water for about one year after they are laid, making it undesirable for use.

Colors Are Unfading

The surfacing of chipped slate on Niagara Shingles will not fade to any appreciable extent, as it is the rich, natural color of the slate itself. A very good way to appreciate the actual colors of the chipped slate on Niagara Shingles is to dip a sample in water. The fresh, bright colors will surprise you. Try this.

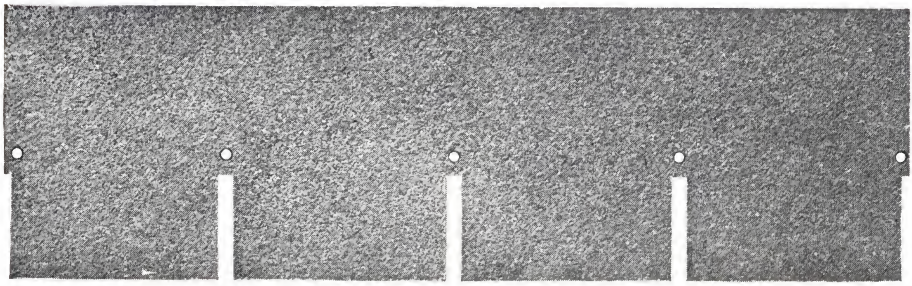
Stained wood shingles must be restained at intervals, if they are to look well, because the stain fades somewhat. Niagara Shingles are unfading—permanent—and they will outlast the best grade of wood shingles and look better on the roof.

Made in Red, Blue Black and Green

Niagara Shingles come in three colors: a beautiful dark red, blue black and grayish green. These shades are the natural colors of the slate that is embedded in the asphalt. Each shingle is 8 inches wide and 12½ inches long.

Niagara Asphalt Strip Shingles

Slate Covered



Made in Dark Red, Grayish Green and Blue Black

MANY people prefer a roof with the old style square shingle appearance. For those who want this effect, with the maximum protection afforded by the patented slab construction, and without all the fuss and uncertainty of applying one shingle at a time, we offer our Niagara 4-Slab Shingles.

This style of shingle gives exactly the same appearance as individual shingles—no expert in the world can tell the difference on the roof. In fact, the Niagara 4-Slab Shingles look even better than individual shingles, because they can be laid so accurately—there is no guesswork about the application.

Each slab shingle is 10 inches wide, 32 inches long, with slots ½ inch wide, 4 inches deep. The slots are a uniform distance apart, and the shingles are so notched at both ends that another perfect slot is formed by the joining of two slabs. That is what gives the uniform neat appearance. Niagara 4-Slab Shingles show a saving of at least 50% in labor, because FOUR shingles are put in position at ONE time, instead of one shingle at a time. The slots in the shingle act as a gauge—they make the shingles self-spacing—no chalk lines are necessary—that is why they can be laid so quickly.

The four shingles are held with five nails, and each nail is placed ½ inch back of the slot. This means a saving of 38% in the nails. Each course of shingles is applied so that the bottom of the slab comes just to the top of the slot of the course below. All nail heads on the course below are protected by each course of shingles. Niagara 4-Slab Shingles give maximum protection on the roof, because the shingles fit right up close to each other—there are no spaces for the rain, wind, snow or dust to blow through into the building.

For convenience in handling the shingles are packed two bundles to a square—this is enough to cover 100 square feet. Not only are Niagara 4-Slab Shingles reasonable in first cost, but their long life makes them really economical. That is why they are being used on some of the finest residences, churches, club houses, etc., in the country.

Made in red, blue black and green slate finish.

Beauty

NIAGARA SHINGLES are made to make homes beautiful, because every home owner wants an attractive structure—something that will be distinct and different. Most people are judged by their surroundings and Niagara will make a roof that will at once command admiration. The beautiful and natural shades of Red and Green crushed slate used in the making of Niagara Shingles are the work of Nature—they come to us from the quarries of Vermont—the color is just as enduring as the mineral itself. There is nothing flashy or gaudy about Niagara—the subdued harmonious shades of the natural colored slate are really beautiful to look at and the craftsman texture of Niagara is something that cannot be equalled by any stained wood or metal. Niagara enables the builder to plan the work to a definite color scheme because the attractive tones of Niagara are permanent colors—they never fade—each rain helps to make them richer in appearance. All this natural Niagara beauty is yours without any extra cost.

Durability

A good roof should be just as permanent as the foundation and Niagara durability has been established by years of unusual exposure to weather conditions all over the world. The Niagara composition, from which all Niagara Shingles are made, is the most waterproof substance known to science. This substance is fused with long, tough fibres, under the Niagara process until it becomes a tough, rubbery mass. Into this Niagara composition we roll the beautiful shades of Red and Green crushed slate making one solid welded unit that will not rot, rust, crumble, or decay. Positively no evaporating elements of any kind are used in making Niagara Shingles. For this reason Niagara will not become porous nor are they in any way affected by gases, acids, or alkalis, and rain water from a Niagara roof can be used for domestic purposes. Great extremes of heat or cold have no effect on Niagara Shingles—they will not run in summer or crack in winter. Niagaras are strong and stiff, yet sufficiently pliable to conform to any graceful architectural curves, and, when properly applied according to our printed instructions, do not flutter in the strongest wind.

Economy

Economy has been our watchword ever since Niagara was introduced. Niagara Shingles are easy to lay because they are of uniform size and color and it takes less nails than with any other kind of shingles. Niagara can be applied right next to the sheathing boards, or they can be put on right over old wood shingles. Excellent results can be easily obtained by either method. If Niagara is applied over old wood shingles it saves all the muss and fuss of removing the old shingles. This means a big saving in labor. The value of an old building can be increased from 25% to 50% by the use of Niagara on the roof. No roof covering of any kind will last longer than the nails which support it. When Niagara Shingles are used, no nails are exposed to the weather. Each nail as it passes through a Niagara Shingle takes a coating of the Niagara composition with it, which prevents the nail from rusting. Burning sparks or brands falling on a Niagara roof will not cause it to ignite—fire will not run on Niagara.

Niagara Roll Shingle

For Beauty, Economy and Durability

THE perfect roof must combine both beauty and durability, and still be easy to apply. Any roof that is unsightly or grows ugly with age not only spoils the appearance of the home, but lowers its cash value. At the same time wearing qualities cannot be sacrificed for appearance.

Most all home owners agree that Niagara Asphalt Shingles make the most attractive roof on the market, but everyone cannot afford them even though Niagara Asphalt Shingles are the cheapest roof covering in the long run. To give the asphalt shingle effect at a moderate price has been the aim of every manufacturer. The problem has been solved. Now we can offer you the Niagara Roll Shingle Roofing—an attractive, durable, easy-to-lay, fire resisting roof covering at a price within the reach of every home owner.

Every desirable feature a roofing should have will be found in Niagara Roll Shingle Roofing. This product is made from only the highest grade materials throughout. The felt is especially selected for its long fibre and strength. Only high melt point Asphalts are used in the saturation. Not a drop of volatile oil is used in the manufacture of this roofing. There is therefore nothing to evaporate or dry out. This means durability.

After the roofing has been thoroughly saturated three times by our special process, it is given a rich, extra-heavy coating of special weather resisting asphalt, into which we roll the beautiful natural shades of Red and Green crushed slate. The Red and Green crushed slate is a natural product and absolutely no artificial coloring whatever is used. For this reason the colors are permanent—they will not fade—each rain makes them brighter and more attractive.

No paint or imitation stunt of any kind is used to get the Shingle effect. The roofing while still hot passes through especially constructed rollers which raises or moulds the asphalt into the form of Asphalt Shingles with five by ten inch butts. The roofing is not weakened in any way by burning or scoring. The dividing up and down and also the cross lines cast a natural shadow which gives the appearance of actual individual shingles. You can feel the shingles—each shingle is a separate unit—each one stands out by itself, yet they are all in one piece.

Niagara Slate Covered Roofing

In Roll or Shingle

A HOME-OWNER is always interested in the roofing to be chosen. The architect and contractor also give great consideration to this phase of building. But no matter how discerning or discriminating they are, they find Niagara Slate Covered Roofing ideally fitted to their plans.

Here is a roofing that comes in roll form or in shingles, either single or strip.

The roll roofing is easy to apply, no more costly in labor and gives a beautiful appearance, greatly enhancing the structure to which it is applied.

"Niagara" Shingles are made with ease of installation as a paramount factor. The single shingles are made to save time, labor and cost. The strip form of four shingles to the slab are even more convenient, with long slits that serve as a gauge in laying and as a guide between what appear as individual shingles. You cannot tell the slab from individual shingles, and you can lay quicker and cheaper.

"Niagara" Roofing is fire protection as well as beauty insurance. They are windproof and sunproof. They are durable and economical. They are adapted to almost any type of building. They come in Red and Green and a beautiful Blue Black.

We can make immediate shipment wherever desired.

Niagara Smooth Surface Rubber Roofing

NIAGARA is our best grade of Smooth Surface Rubber Roofing—it has proven to be deservedly popular, having made satisfied users for many years due to its attractive appearance, ease of application and durability as well as many other qualities it possesses, and it is unequalled for the type of building requiring a good serviceable roofing at a reasonable cost.

The highest grade of carefully selected wool felt is used as its base, which is densely compressed and saturated with the highest grade of specially prepared asphalt, the best waterproofing agent known.

Because of the quality of asphalt used this felt is unusually strong, tough and pliable, retaining these qualities indefinitely. The specially treated asphalt used in Niagara Smooth Surface Rubber Roofing gives the Niagara Brand its high quality, and renders it proof against acids, gas, steam, etc. It is equally satisfactory during all seasons of the year, extremes of heat or cold having no injurious effects. The best protection against fire as demonstrated by practical tests.

This roofing is made in three weights: Light, Medium and Heavy and weights full 35, 45 and 55 lbs. to the square. Niagara Smooth Surface Roofing is packed 108 square feet to the roll and each roll contains Nails and Cement and directions for application.

Samson Smooth Surface Rubber Roofing

THE Samson grade of Roofing has been put on the market to meet a demand for a lower price Roofing and we can guarantee it to be the equal of and far superior to many Rubber Roofings that are sold at the price of the Samson. It is made from a very good grade of felt and is full weight and contains no sand.

If our Niagara and Samson Roofings are painted every three years with our Asphalt Roof Coating they will, if they have been properly applied, last indefinitely.

We carry a full stock in our Pittsburgh warehouses at all times and can make immediate shipment either direct from the factory or from Pittsburgh.

Roofing Brushes

Three Knot

OUR special three knot brushes are particularly adapted for painting large roofs and are considered by many satisfied users, a great labor saver, paying their cost many times over.

These brushes, when not in use, do not have to be kept in oil to keep the bristle soft and pliable; placing the brush in a bucket of water is sufficient to keep it ready for immediate use.

For Waterproofing Work

We also carry in stock a four knot brush which is especially adaptable to waterproofing work.

Cabot's Sheathing and Deafening Felt

For Deafening Sound and Insulation

Heat-proof—Rot-proof—Vermin-proof—Fire-resistant

CABOT'S QUILT is a thick, resilient matting of cured eel-grass quilted between sheets of wonderfully strong Kraft paper. The eel-grass has a tough, flat fibre that forms thousands of dead-air spaces, making an insulating layer that the tests proved was superior even to cork board, which now costs over five times as much.

Eel-grass grows in the sea and is composed of Silicon in place of the Carbon that exists in plants that grow in the air, and it therefore will not rot, will not harbor insects or vermin, and will not burn.

This combination of insulating power, permanence, sanitary qualities, and fire resistance makes Quilt the ideal insulator, and its low cost enables the owner of the most inexpensive plant to have the most perfect insulation. A frame building can be as completely insulated, at relatively small expense, as the most costly plant, and Quilt is so easy to apply that any intelligent workman can lay it with success.

Cabot's Ready Roofing Stains

For Asphalt Shingles and Prepared Roofing

THE dullness of the colors of ready roofings, asphalt shingles, asbestos shingles and similar materials, growing duller and more lifeless after they have been exposed to the weather for a time, has produced a persistent and growing demand for a suitable coloring that would give fresher and more lively colors and really attractive coloring effects upon the roofs. Shingle stains and common paints would not serve because the asphalt would dissolve under the action of their liquid thinners and neither of these articles had the binding and protecting qualities which the roofings so greatly need.

Wearing Power Greatly Increased

Cabot's Ready Roofing Stains not only produce the desired rich coloring effects on all kinds of asphalt shingles and ready roofings without dissolving the asphalt or injuring the felt base, but they also greatly increase the wear-resisting qualities of the surface.

Increased Fire Resistance

These Stains make all asphalt roofings much more fire-resistant, by preventing the melted asphalt from running when heated by fire from above or below. When hot the asphalt stews out and runs, burning hotly with a dense smoke, but the fire-resisting binder of the Stain holds back the melted asphalt and greatly reduces this danger.

Cabot's Creosote Shingle Stains

Creosote Stains vs. Paints

THE base and principal ingredient of Cabot's Creosote Wood Stains is a specially refined Cresol, or "Creosote," which all authorities agree is the most effective preservative of all vegetable tissues.

Creosote has great penetrating power, and in a few hours it thoroughly permeates and preserves the wood.

Insects will not attack Creosoted wood, which fact, together with the wood-preserving qualities, makes the stains especially valuable in the South, in preventing the ravages of the white ant; and even under water they resist the teredo, or naval worm. We alone make **bona fide** Creosote Stains.

Paint forms an air-tight skin over the surface of the shingle, sealing the pores and preventing the evaporation of the moisture which always gathers on the under side. This moisture, running down into the butt of the shingle, causes it to rot very rapidly; and it is often the case that a painted shingle which looks sound from the outside will be found to be completely rotted away underneath. There is no wood-preserving ingredient in paint. On the other hand, Creosote Stains, being thin and in the wood, form no skin and permit the ready evaporation of any moisture which may get into the shingles; and in either case the Creosote absolutely prevents wet or dry rot. Every ingredient of our Stains has a beneficial effect upon the wood.

Tarred Felt and Slaters' Felt

TARRED felts are made of several weights to accommodate sundry needs, but in no case is the quality varied. They each consist of the best grade of wool felt, evenly saturated with pure distilled coal tar.

No. 1 Tarred Felt

No. 1 Tarred Felt is the heaviest weight made; about 25 pounds to 100 square feet; is 32 inches wide, and rolls will weigh from 50 to 60 pounds each. This felt is used largely both as roofing and sheathing; for lumber camps, ranches, cattle and sheep sheds, poultry houses, etc.

No. 2 Tarred Felt

No. 2 Tarred Felt is the roofing and sheathing felt mostly used. It is the medium weight; about 16 pounds to 100 square feet, is 32 inches wide, and rolls will weigh from 50 to 60 pounds each. For sheathing and roofing purposes it is unexcelled, and will always be the popular weight of tarred felt with the trade.

No. 3 Tarred Felt

No. 3 Tarred Felt weighs about 12 pounds to 100 square feet, is 32 inches wide, and rolls will weigh from 50 to 60 pounds each. It is largely used by the roofing trade, with whom it is in demand.

No. 1, 2 and 3 Tarred Felts are sold by weight only.

Slaters' Felt

Slaters' Felt is made from the same high-grade materials as the Tarred Felts above listed, but it is put up in measured rolls 36 inches wide and containing 500 square feet. It is extensively used for lining under slate, tile, shingles, etc. Weight about 35 pounds per roll and sold by the roll only.

Coal Tar Roofing Pitch

PITCH is the solid residuum resulting from direct distillation of coal tar. Our Pitch is made in first quality only, but of several consistencies, as best adapted for different purposes. It is strictly "straight run," i. e., none of the valuable properties of the coal tar are removed in process of distillation.

Roofing Pitch is carefully distilled to the proper consistency for roofing purposes, millions of pounds being annually used in the making or repairing of the standard felt, pitch and gravel roofing. Its high quality will be vouched for by all expert roofers, who well know that poor pitch is never cheap enough to induce its use. Those not familiar with handling pitch should bear in mind that it comes in solid form, requiring heating or melting in a kettle before ready for use. Our Roofing Pitch is put up in barrels, weighing from 300 to 600 pounds, and is sold by weight only.

Refined Coal Tar

Refined Coal Tar is the entire product of pure coal tar, from which only the water has been taken off in distillation, retaining all the valuable properties of coal tar. As the water in crude tar represents a large percentage, its entire elimination from our refined tar makes the point of price, as well as quality, in favor of its use. Refined Tar is put up in well coopered barrels, containing 50 gallons; weight, including package, about 575 pounds. It is sold by the barrel.

Slag Cement Roof Coating

This Coating is especially prepared to apply on our 2 and 3-ply Red Label Roofing. Its freedom from mixtures containing water, sulphur and ammoniacal salts, and its adaptability for ready and immediate use, make this coating particularly desirable for all paper, felt and composition roofings. It preserves new roofs, repairs old roofs, prevents leaky roofs and prolongs the life of any roof. It is put up in any size package, ready for the brush. Weight, including package, about 12 pounds per gallon. Sold by the gallon.

Red Rosin Sheathing Papers

OUR papers are carefully made of the best selected rag and wood pulp stock, rolled under pressure and properly sized. Red papers are colored with oxide of iron when in pulp form and are generally called for. We carry a full stock in both red and grey rosin sized. The numbers below given (for rosin sized only) indicate the number of square feet to a pound; No. 25 being the lightest and No. 12 the heaviest. We recommend No. 12 as the proper weight for general use as a sheathing paper.

No. 25 Red Rosin, weight about 20 pounds .....500 square feet per roll
No. 16 Red Rosin, weight about 30 pounds .....500 square feet per roll
No. 12 Red Rosin (grey center), weight about 40 pounds..500 square feet per roll

Insulating and Waterproofing Papers

We make a specialty of high-class papers for building purposes. If you want something to resist moisture and dampness then you must have a waterproof paper. If you want something to keep out the cold and keep in the heat for houses, or, vice versa, for refrigerators, ice boxes, etc., then you must have an insulating paper. We carry the following stock as below described giving use in detail.

No. 110 Stencil Paper (not oiled) .....500 square feet per roll
Houston's Black Waterproof .....500 square feet per roll

No. 110 Stencil Insulating is made of long Manila fibre and is especially adapted for lining ice houses, refrigerators and high-class buildings. Does not contain oil of any kind and cannot impart any odor, is well adapted and used for drafting paper, stencil purposes, and paper patterns.

Wool Felt

We carry selected grades of paper for deadening sound, for use under carpets and for covering heating pipes, etc.

No. 9 Wool Deadening Felt, weight about 50 pounds.....450 square feet per roll
No. 6 Wool Deadening Felt, weight about 75 pounds.....450 square feet per roll
No. 4 Wool Deadening Felt, weight about 100 pounds.....450 square feet per roll

No. 9 Deadening Felt is sometimes used for high-grade carpet felt. We recommend it for this purpose if you want something nice, and it is more economical in the end as it can be used over.

Mineral Wool

MINERAL WOOL is so called because in appearance (only) it resembles sheep's wool. It is manufactured from blast furnace slag or a natural rock of similar composition to the slag. Rock wool is said to be the best.

Mineral Wool possesses many of the valuable features of asbestos and is often in error called asbestos. Mineral Wool is the great fire resistant made by man. Asbestos is one of the wonderful products of nature.

Mineral Wool—Its Uses

To prevent spread of fire, has no equal. Frame buildings filled in between walls make a building almost fireproof. The air spaces between partitions cause the rapid spread of flames; when the space is filled with such a non-conductor as Mineral Wool the flames cannot spread, and in nine cases out of ten the fire would be extinguished before much damage could be done.

Rats, mice or insects will not penetrate Mineral Wool; a building having the walls packed with Mineral Wool will be proof against all kinds of vermin.

The use of this mineral for filling the outside walls of residences, and between rafters of buildings of all kinds for the purpose of protection against heat in summer and cold in winter, is constantly growing as the merits of this material become known. A residence can be warmed with one-third less fuel protected in this manner, and the cost saved in fuel in a few winters. Chambers in residences, public halls, ballrooms, offices in upper stories of public buildings are intolerable in summer and expensive to heat in the winter. Mineral Wool filled between roof timbers will obviate these troubles. Rooms under roofs can be made as comfortable as those on the first floor.

The cost is about one-half what it has been during recent years.

Its use is just as necessary in hot climates as in cold.

Mineral Wool is packed in cloth bags weighing about 50 pounds per sack.

We carry a large stock at all times.

How to Estimate Mineral Wool

The Quantity of Mineral Wool Required for Buildings

MANY frequently overestimate in consequence of not making sufficient deductions for openings, thickness of studding, joists, etc. We therefore append rules for estimating and an example or two as a guide in determining quantities needed. Taking for an example a building 32 feet front, 48 feet deep, with studding 24 feet high.

To Find the Quantity of Mineral Wool Required to Fill the Outside Walls the Full Thickness of Studding

Take the entire distance around the building on a horizontal line and multiply by the height of the studding, which will give the square feet of outside surface. Deduct ordinarily, one-half for space occupied by doors, windows, chimneys, studding, braces, etc. Multiply the remainder by the thickness of the studding and divide the product by twelve, which will give the number of cubic feet of Mineral Wool required to fill the space. Multiply this by eight for the number of pounds required.

Example.—Building 32 x 48 feet; studding 24 feet high, 4 inches wide.

Distance around building 160 feet $\times$ 24 = 3,840 square feet; one-half off for openings, etc., leaves 1,920 square feet; 1,920 $\times$ 4 = 7,680 $\div$ 12 = 640 cubic feet; 640 $\times$ 8 = 5,120 pounds No. 1 wool required quantity for entire outside walls, full width of studding.

To Estimate the Quantity of Mineral Wool Required to Fill a Given Space

Find area to be covered (by multiplying length by breadth) and allow about 10% for beams, etc.; then multiply by two-thirds of a pound for each square foot filling one inch deep.

This rule is based on the assumption that each cubic foot of Mineral Wool runs from 8 to 10 pounds.

Example (Mineral Wool)

Room floor 16 feet $\times$ 20 feet $\times$ 2 inches deafening.

16 feet $\times$ 20 feet = 320 square feet.

32 square feet, = 10% for beams.

288 square feet, = net surface.

2 pounds to each square foot 2 inches deep.

576 pounds Mineral Wool required.

Slate

And Its Value As a Roofing Material

THE VALUE of a roofing material is determined by a variety of considerations, among which the most important are first cost, durability, appearance, resistance to fire and consequent influence on the cost of insurance, and the expense of maintenance and repairs. Below you will find a valuable table showing a comparative estimate cost of the leading materials used by the roofing trade. This estimate is based on the "square"—100 square feet of surface—laid on the roof in the vicinity of Philadelphia and New York.

It will be readily seen that a slate roof is not only the most durable, but when the original cost and average life are taken into consideration, it is three and a half times cheaper than tin, four and a half times cheaper than shingles, six and a half times cheaper than iron, and twelve times cheaper than copper. Again, slate is far preferable to metal or wood for roofing when considered from a sanitary standpoint. This is especially the case in the country and smaller towns where cisterns are largely depended on for water supply. The clean, pure slate forms a striking contrast to the rust, paint, or wood-rot of other roofs, when the roof is used for the purpose of collecting pure rain or snow water to be stored in cisterns for domestic, barnyard or stable use.

Material	Average Life in Years	Average Cost per Year
Slate	75	$ 3.6
Tin	20	27.5
Shingles	12	35.3
Corrugated Iron	10	57.2
Tin Shingles	10	67.2
Copper	30	100.0

Varieties of Slate

No. 1 Slatington Big Bed

THIS slate is quarried in the Slatington district of Eastern Pennsylvania, where such well known brands as the Franklin Tunnel, Columbia Big Bed and Hazel Dell are found. A strictly high-grade, unfading slate made from one large roofing vein, and is, therefore, uniform and unfading in color. It is carefully selected (free from ribbons or streaks of any kind) and as nearly perfect as slate can be quarried. We recommend this slate where a dark black roof is desired. It can be guaranteed as entirely satisfactory and suitable for the very highest class of buildings. It is used in the most expensive residence work in Pittsburgh.

Genuine Clear Bangor

The production of this slate is strictly confined to the quarries located at Bangor, Pa., and is known as Genuine Bangor Slate to distinguish it from other districts. No. 1 Clear Bangor is a strong, black slate free from any ribbons or imperfections. A ribbon is a streak or separation in the bed of slate rock and shows in the finished slate, somewhat resembling a ribbon. No. 1 Clear Bangor is favorably known to the trade as a high-class slate.

Genuine Bangor Ribbons

No. 1 Ribbons are the ribbon slate from the Bangor quarries as above described. No. 1 Ribbons contain one or more ribbons, but in such position that they can be laid on a roof without being visible; in other words, the lap will cover the ribbons. Where there are several ribbons they are known as No. 2 Ribbons and cannot be covered. Ribbon Slate is always in good demand and generally scarce.

Jackson Bangor and Albion Bangor

A high-grade slate quarried in the Bangor district; in fact, right beside the Genuine Bangor Quarries. Our Jackson Bangor is similar in quality to the Genuine Bangor and it is doubtful if even an expert can tell any difference. Some of our customers prefer it to the Genuine Bangor as it is economical and gives most excellent satisfaction. This slate comes in No. 1 Clear and Ribbons. We recommend it to you.

No. 1 Superior Sea Green

This is one of the toughest and best wearing slates on the market. The color is not so uniformly permanent as in the more expensive grades of black slate, such as our Slatington Big Bed. However, where a good,

Varieties of Slate

tough, strong slate at an economical figure is required, nothing better can be found than No. 1 Sea Green. It is largely used for the medium grade of residences, warehouses and barns, and in so far as quality is concerned, has never failed to give satisfaction.

Chapman Slate

A hard vein slate of extreme strength and toughness. This slate is of such character that it requires the use of a diamond saw to cut the slate slabs. Will stand much hard usage in transit or on the roof. It is not a clear slate, but as one slater said, "If you want a slate roof that you can walk on without breaking, use Chapman." Made in No. 1 and B grades.

Buckingham

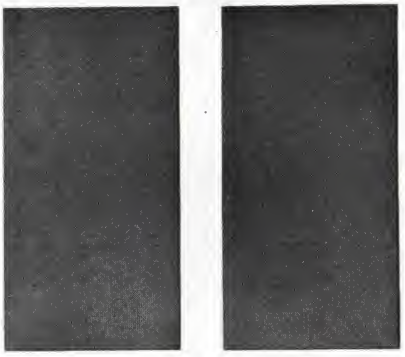
A high-grade slate quarried in Virginia, and by reason of freight rates to Southern points is economical. The quality is desirable and can be recommended.

Unfading Red and Green

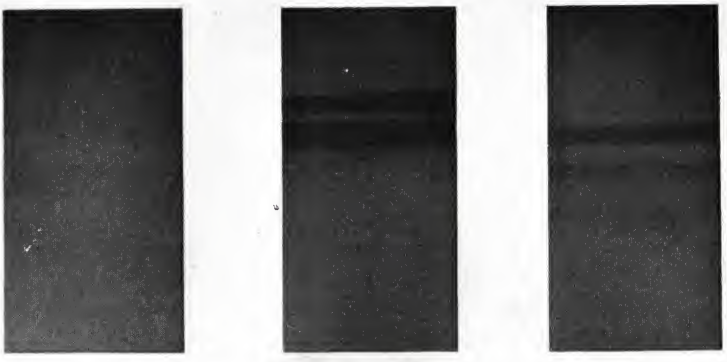
These slates are absolutely unfading and come in different shades of color. We can give you bright red and dark red as may be required, and any slate ordered will be absolutely uniform in color. Unfading Red and Green slate should be used wherever color or color schemes are required, and their beauty for country homes or high class city work is unquestioned. The quality of this slate is the best and the color is permanent.

Various and Special Slate

There are a few other well known, expensive, high-grade slate, such as Monson Maine, Brownville, etc. Also specialties like Grey Slate, Purple, Mottled and Variegated Slate in colors which we can furnish. Practically all the slate quarries in the country are located in the eastern portion of the United States, in and not far from the Pennsylvania district, so that our line is complete and we are in position to look after your interests. Colored slate and black slate cannot be shipped in the same carload, as colored slate is quarried in Vermont, and black slate as described. We can also furnish slate in special cut sizes or shapes and extra thickness, if desired. Slate can be punched at quarry ready to be laid or in extra thickness bored and countersunk. Additional charge is made for such work over list prices.



No.1 Slate.



No.1 Ribbon Slate.

No.2 Ribbon Slate.

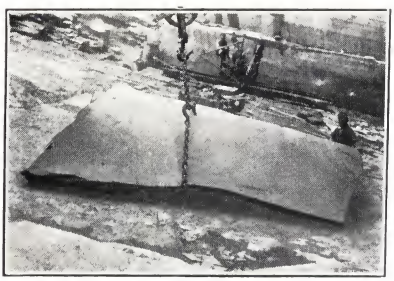
KINDS OF BANGOR SLATE
No. 1—Clear
No. 1 and No. 2—Ribbons

Slate Quarries

And Its Process of Manufacture

Looking down into the "hole." Some of them are over 500 feet deep.

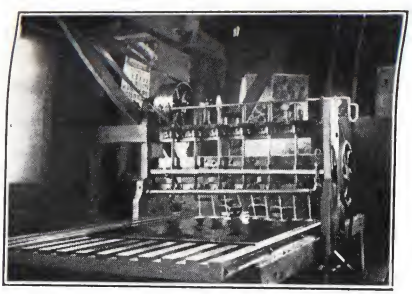
At the bottom of the "hole." It has taken thirty-five years to excavate to this depth.



A four-ton slab as it is taken from the quarry.

Splitting is a delicate process, but to a professional "splitter" it seems to be simple.

The rubbing bed. This is really a grinding operation done by means of fine sand and water.



One of the improved modern machines for polishing slate.

Roofing Slate Table

GIVING the different sizes of Roofing Slate that are made, the exposure of Slate when laid on the roof, and the distance that lath should be apart (allowing for a three-inch lap), and the number of each size in a square.

Also showing the number and weight of Nails in pounds and ounces required to lay one square of the different sizes of Slate.

Regular Sizes of Slate Made	Exposure of Slate on Roof and Distance of Lath Apart	Number in Square	Weight of Nails to a Square											
			4d.						3d.					
			Gal.		Tin.		Wire Com.		Gal.		Tin.		Wire Com.	
Size Inches	Inches		Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.	Lb.	Oz.
6 x 10	3½	686	7	0	7	0	7	0	7	0	7	0	7	0
7 x 10	3½	589	6	14	6	2	5	8	6	2	5	2	5	4
8 x 10	3½	515	7	7	6	3	5	10	6	3	5	4	5	8
6 x 12	4½	533	7	6	6	1	5	9	6	1	5	2	5	6
7 x 12	4½	457	6	6	5	3	4	12	5	3	4	6	4	5
8 x 12	4½	400	5	9	4	9	4	3	4	9	3	14	3	12
7 x 14	5½	374	5	3	4	4	3	15	4	4	3	10	3	9
8 x 14	5½	327	4	9	2	12	3	7	3	12	3	2	3	1
10 x 14	5½	262	3	6	3	3	3	1	3	0	3	0	2	2
8 x 16	6½	277	3	14	3	2	2	14	3	2	1	10	2	15
9 x 16	6½	247	3	17	2	13	2	9	2	13	2	6	2	1
10 x 16	6½	222	3	1	2	8	2	5	2	8	2	2	2	0
9 x 18	7½	214	3	8	2	7	2	4	2	7	2	1	2	3
10 x 18	7½	192	2	11	2	3	2	0	2	3	1	14	1	10
12 x 18	7½	160	2	9	2	1	1	14	2	2	2	0	1	14
10 x 20	8½	170	2	6	1	15	1	13	1	15	1	11	1	9
11 x 20	8½	154	2	2	1	12	1	10	1	12	1	8	1	7
12 x 20	8½	142	2	0	1	10	1	8	1	10	1	6	1	5
11 x 22	9½	138	1	15	1	9	1	7	1	9	1	5	1	4
12 x 22	9½	127	1	12	1	7	1	5	1	7	1	4	1	3
13 x 22	9½	117	1	10	1	5	1	3	1	5	1	1	1	1
14 x 22	9½	108	1	9	1	4	1	1	1	6	1	1	1	12
12 x 24	10½	115	1	10	1	6	1	3	1	5	1	2	1	1
13 x 24	10½	106	1	9	1	5	1	2	1	1	1	0	1	0
14 x 24	10½	98	1	6	1	2	1	0	1	2	0	14	0	14

By a "Square" of Slate is meant a sufficient number of Slate to cover 100 square feet on roof, allowing for a three-inch lap.

Weight per Square of Various Roofing Slates

(APPROXIMATE)

No. 1 Sea Green	weighs	625 pounds per square
No. 1 Slatington Big Bed or Bangor	weighs	650 pounds per square
No. 2 Slatington Big Bed	weighs	700 pounds per square
Peach Bottom	weighs	700 pounds per square
Standard No. 1 Unfading Red or Green	weighs	725 pounds per square
3/16-inch Unfading Red or Green	weighs	725 pounds per square
1/4-inch Unfading Red or Green	weighs	1,000 pounds per square
3/8-inch Unfading Red or Green	weighs	1,500 pounds per square
1/2-inch Unfading Red or Green	weighs	2,000 pounds per square
Variegated Green and Purple	weighs	750 pounds per square

The minimum carload of slate is 30,000 pounds. This, of course, subject to change by the railroads.

A Few Useful Suggestions and Rules

To ascertain the number of squares of roofing required to lay a certain roof, multiply the total length of rafters by the length of the building and divide by 100, making allowance for flashing and waste according to the irregularities in the surface.

The pitch of a roof is the relation of the height of the ridge, above the level of the roof plates to the span. The "span" is the distance between the plates, or supports upon which the roof rests.

The length of rafters for the ordinary pitches may be found as follows where the span is known.

For 1/4 pitch, multiply span by	.559,	or	7/12 about
For 1/3 pitch, multiply span by	.6,	or	3/5 about
For 3/8 pitch, multiply span by	.625,	or	5/8 about
For 1/2 pitch, multiply span by	.71,	or	7/10 about
For 5/8 pitch, multiply span by	.8,	or	4/5 about
For full pitch, multiply span by	1.12,	or	1 1/8 about

To these lengths must be added the amount of projection for cornice.

Knowing the size of a building, the number of squares of roofing for a given pitch required to cover the same can be found approximately, by multiplying the length of the building by the breadth, and adding to that product that fraction of itself opposite the pitch as given below:

For 1/2 pitch add 1/2	For 1/4 pitch add 1/6	For 1/8 pitch add 1/11
For 1/3 pitch add 3/10	For 1/6 pitch add 1/8	For 1/16 pitch add 1/12

These figures allow one foot all around for cornice. Divide by 100 to find number of squares.

Slate Table

A short and convenient method of calculating the number of squares and feet in any number of slate according to size.

For example. There are 59 feet in 100 slate, size 10 x 20, multiply 59 by 1,000 and you have 59,000. Mark off the decimals and you have 5 squares and 90 feet. Again take 399 slate and multiply that by 59 and you have 23,541, mark off the decimals and you have 2 squares and 35 41-100 feet, etc., etc.

Size Slate	No. Feet in 100 Slate	Size Slate	No. Feet in 100 Slate	Size Slate	No. Feet in 100 Slate
6 x 12	19	9 x 18	47	13 x 22	86
7 x 12	22	10 x 18	52	14 x 22	92
8 x 12	25	11 x 18	57	15 x 22	99
7 x 14	27	12 x 18	63	16 x 22	106
8 x 14	31	10 x 20	59	12 x 24	88
9 x 14	34	11 x 20	65	13 x 24	95
10 x 14	38	12 x 20	71	14 x 24	102
8 x 16	36	13 x 20	77	15 x 24	109
9 x 16	41	14 x 20	83	16 x 24	117
10 x 16	45	11 x 22	73	17 x 24	124
11 x 16	50	12 x 22	79	18 x 24	131

The above figures represent square feet as laid on the roof, and while it is not accurately correct in every instance according to "Stafford's Tables" (on account of the fractions not being calculated), it is accurate enough to enable a person quickly to tell how many squares and feet they have in a given number of slate.

How to Ascertain the Number of Squares in a Roof

The number of squares in a roof can be readily ascertained in the following manner: For example, suppose the rafters are 15 feet, and the length of the roof 35 feet; 35 multiplied by 15 is equal to 525. The opposite side, being equal, would measure the same, making the whole surface 1,050 square feet, requiring 10 squares and 50 feet of slate to cover the surface.

General Remarks

Slate before being laid on the roof, should be carefully selected in two thicknesses—the thick ones to start the roof at the bottom or eaves, and the thin ones to finish the roof at the comb.

Slate cut and punched by machine is much superior to that cut and punched by hand and not so liable to break by nailing.

In nailing slate on the roof care should be taken that the slate is not drawn too tight by the nail. The top of the nail should just be flush with the surface of the slate.

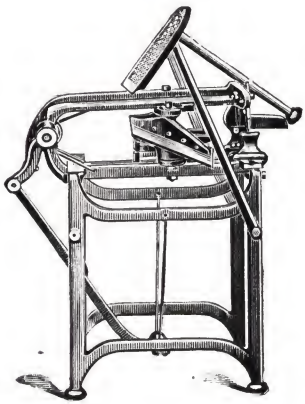
A building strong enough for shingles, tin or iron roofing, is strong enough for slate. Rafters two by six inches, eighteen feet long, two feet apart, are strong enough to carry a slate roof. The more pitch, however, a roof has the better it is for slate, and it should never be less than one-fifth.

Handling Slate

Slate should never be laid flat, but always piled on the edges as nearly perpendicular as possible, as when loaded in cars; nor more than two rows piled on top of each other, separated by lath or boards. Slate should be protected from snow, rain and ice until laid on the roof, thus saving breakage.

Houston Ideal Slate Dresser

A Superior Machine—Strong and Durable



IN presenting this machine to the trade we do so with the full confidence that we have something superior to anything ever offered for dressing slate for roofing purposes. It is very simple in its construction and operation and it requires no skill to adjust or operate.

One set of knives cut octagon, hexagon, diamond or any other desired angle. Also two sets of circle knives to cut convex and concave. For ornamental work it is indispensable and will cut and punch any size slate from 6 to 16 inches wide and from 12 to 28 inches long.

Figures for various sizes of slate: It has on the bed plate figures to represent the various sizes of slate, so that an inexperienced hand can set the machine to cut and punch to Standard Gauge.

The seat is a great convenience, as it holds the operator and machine in the proper relation to each other, and saves the time and trouble of hunting up a keg or block to sit on. The seat folds up when not in use, or for transportation, and requires no extra space.

The treadle also folds up, if desired, so the machine when on the truck can be filled in with spouting, ridging or other material, thus utilizing all the space on your truck.

It is the machine every slater should have.

It will pay its cost in working one hundred squares of slate.

Snow Guards for Slate Roofs

SNOW guards are an important factor in modern roof design. Almost unanimous in popular choice are "Niksah" Snow Guards.

These guards, made of Duplex Copper Wire (patented), combine the durability of copper with the stiffness of steel, because the coating of copper is welded to a steel core. Freight is prepaid on lots of 1,000 or more.

No. 1 Steel Galvanized, 1 in. points .....

No. 3 Steel Galvanized, 2 in. points, for slate laid over shingles or for flat tile roofs .....

No. 4 Regalvanized for old roofs .....

Nos. 1 and 3 Regalvanized after making, extra .....

No. 2 Copper (solid) 1 in. points .....

No. 8 Duplex Copper, 1 in. point .....

No. 11 Duplex Copper, for old roofs .....

Steel Galvanized Slate Hooks, used to replace broken slate .....per lb.

Duplex Copper Wire (patented) is made with a heavy coating of copper, welded to a steel core, giving durability of copper and stiffness of steel.

Free samples showing thickness of copper.

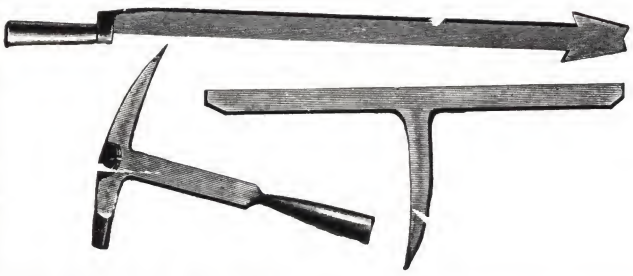
Freight prepaid on "Niksah" Snow Guards in lots of 1,000 or over.

When desired we ship direct to your customers, making you consignor.

Total of Snow Guards Required per Square

On a ¼ pitch roof or less use 50 guards.
On a ⅓ pitch roof or less use 75 guards.
On a ½ pitch roof or less use 150 guards.
Gothic pitch roof, put one in every joint.

Slate Roofers' Tools



THE Quarry Tools are all carefully made, and specially designed to meet the wants of the trade.

These Tools are all hand-forged out of the best Imported Tool Steel. The Hammers are forged out of one solid piece of steel, and are neatly finished with a leather handle, shaped so as to accommodate itself to the hand. In style and shape it has become a great favorite among the slate roofers.

PRICE LIST—F. O. B. OUR WORKS
Slate Roofers' Tools

Slate Roofers' Hammer, solid cast steel ..... $ .....
Slate Roofers' Ripper, solid cast steel, except handle ....
Slate Roofers' Stake, iron ....
Ideal Slate Dresser ....

Silk Fibre Slaters' Cement

Elastic, Fireproof, Durable. Black, Red, Brown

Sold in paste form ready for use. Black, brown and red carried in stock for immediate shipment. Special shades to order. Packed in 25-pound cans and 125-pound tubs.

Is used for bedding or for laying slate and tile roofs, and for repair work it cannot be excelled.

What is a really good roof cement? It must not be too soft—or heat will make it run; nor too stiff—or it will harden and grow brittle.

Brittle cement is worse than none. It shrinks from the joint and acts as a dam to help the water into the leak.

To be just right a roof cement must be tough, yet never harden—it must be elastic (stretch and contract with the roof), yet never "crawl," and it must always and absolutely adhere to the metal, slate or glass which it is to make watertight.

There are many roof cements. Some have one and some another of these good qualities; and some, we regret to say, have none. In our Silk Fibre brand we have combined them all. Our roof cement is tough, elastic, adhesive; and it stays so for all time. It never runs—it never grows brittle—it never "let's go."

Silk Fibre Cement will stick to a joint till the building falls (and maybe after), and you are sure that that joint is tight in any weather.

Are our claims strong? No more so than the cement warrants. There is no other cement in this country made on our formula, or with our peculiar fibre, and none can equal our Silk Fibre brand in combining all essentials of a perfect cement.

Slaters' Nails

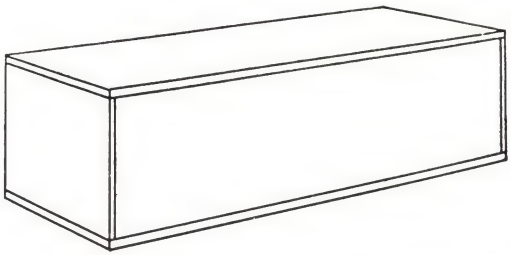
Slating nails are made in various lengths as desired. Steel wire nails are used where a low-priced nail is wanted.

Copper slating nails will not corrode or waste with the weather. These nails are used where nails are expected to last indefinitely. They are quite expensive.

Aluminum slating nails cost more per pound than copper, but as they are but one-third as heavy, the required amount of nails per square costs less than copper. They are as durable as copper and should be considered where a highclass nail is used.

Slate Burial Vaults

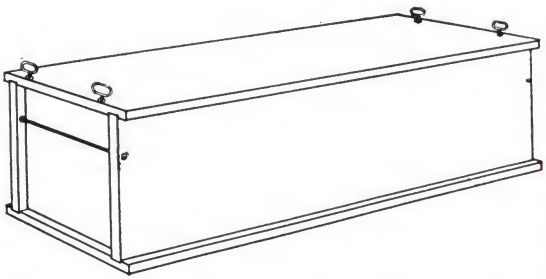
Plain



TOP, bottom, sides and ends are of slate, 1⅜ inch thick. Sides are rabbetted ½ inch into ends. All other joints square. The top is set loose on the sides and ends and the entire vault is held in place by the surrounding earth. All slate will be furnished of Ribbon Stock. Tops and bottoms come in one or two pieces, with plain or rabbetted joints, as specified. Can also be supplied without bottoms. Slate has all edges sawed and rubbed true and flat surfaces are planed.

Plain grave vaults are shipped uncrated, unless otherwise ordered. The prices and weight in pounds given below include all slate to make a complete vault.

Grooved and Bolted



Top, bottom, sides and ends are of slate, each in one piece, 1⅜ inch thick. The ends fit into grooves in the sides, and the ends and sides fit into grooves in the top and bottom. All edges are sawed and rubbed true and flat surfaces are planed. All slate will be furnished of Ribbon Stock. An iron rod or bolt runs through the sides at each end securely holding all parts. When in position the vault is permanently locked. If desired it can be hermetically sealed by the use of a small quantity of slate cement. Iron rods for the ends and rings for lowering the cover into the grave are included with each vault.

Grooved and bolted grave vaults are shipped, crated or uncrated, as desired.

SPECIAL SIZES CUT TO ORDER

Number	Inside Dimensions Length	Width	Depth
1	4'- 0"	1'- 8"	1'- 4"
2	5'- 0"	1'-10"	1'- 6"
3	6'- 0"	2'- 0"	1'- 6"
4	6'- 4"	2'- 1"	1'- 8"
5	6'- 6"	2'- 2"	1'- 9"
5½	6'- 8"	2'- 2"	1'- 9"
6	6'- 9"	2'- 3"	1'-10"

Number	Inside Dimensions Length	Width	Depth
6½	6'-10"	2'- 3"	1'-11"
7	7'- 0"	2'- 4"	1'-11"
7½	7'- 1"	2'- 5"	2'- 1"
8	7'- 3"	2'- 6"	2'- 1"
8½	7'- 4"	2'- 8"	2'- 2"
9	7'- 6"	2'-10"	2'- 3"
10	7'- 9"	3'- 0"	2'- 4"

Structural Slate for Schools

THE constantly increasing use of slate blackboards in many schools is evidence of the thought and study given by architects to the installation of a material which best answers the purpose. The smooth, finely-finished surface which is given to the Pyramid Brand Blackboards of Natural Slate and the care taken in the inspection and workmanship before shipment is such that, when properly installed, perfect blackboards should result. Further data as to the production, finishing and installation of natural slate for blackboards is contained in a booklet which we will gladly furnish, which contains, in addition, detailed drawings showing installations based upon the experience of several of our leading architects.

Sizes and Thicknesses

Note: Whenever the word "width" is used it is to be taken as synonymous with "height."

Natural slate blackboards are produced and carried in stock in three standard widths, 3 feet, 3 feet 6 inches and 4 feet. These three widths comply with nearly all usual requirements in connection with blackboards for class rooms. The slate can, however, be cut to any desired width to suit special requirements or dimensions.

In lengths, the slate is cut to fit the dimensions of the spaces. The general practice followed, unless specific instructions are given, is to provide single slabs for spaces 4 feet 6 inches long; two slabs for spaces 4 feet 6 inches to 9 feet; three slabs for spaces 9 feet to 13 feet 6 inches, etc. No slab should be less in length than its width, but in filling any desired space the slabs may vary in length by not to exceed one foot.

The thickness of the finished blackboard should not be more than ⅜ inch nor less than ¼ inch. This allows the slabs to be properly set with a true, uniform, flush surface, including joints.

GRADE	HEIGHT OF CHALK TROUGH		HEIGHT OF BLACKBOARD		TOP OF BOARD ABOVE FLOOR	
	New York	Boston	New York	Boston	New York	Boston
Kindergarten	2′ 0″	2′ 2″	4′ 0″	4′ 0″	6′ 0″	6′ 2″
1st, 2d, 3d	2′ 0″	2′ 2″	4′ 0″	4′ 0″	6′ 0″	6′ 2″
4th	2′ 6″	2′ 4″ 2′ 6″	3′ 6″	4′ 0″	6′ 0″	6′ 4″ 6′ 6″
5th, 6th	2′ 6″	2′ 8″	3′ 6″	4′ 0″	6′ 0″	6′ 8″
7th	3′ 0″	2′ 8″	3′ 6″	4′ 0″	6′ 0″	6′ 8″
8th	3′ 0″	2′ 8″	3′ 6″	4′ 0″	6′ 6″	6′ 8″
High Schools	3′ 0″	2′ 8″	3′ 6″	4′ 0″	6′ 6″	6′ 8″

For Colleges it is usual to set the board 3 feet above the floor and use a 4-foot width.

FACE BRICK

The Everlasting

IF we possessed the story-telling magic of Sir Walter or of Dumas, the elder, we could write a best seller on the subject of brick, which most people think of as very commonplace. The extraordinary material out of which brick are made, their remote antiquity, long honorable history, and wonderful development for architectural uses in modern times could be woven into a most fascinating story if the present aim was historical or literary. But our purpose is the more modest one of giving you the practical value as a permanent, economical, and beautiful building material.

If aristocracy prides itself on its ancient lineage and honorable service, then brick may claim to be a very aristocratic material. Or, if strength and refinement come to men through the experiences of trial and difficulty, then brick too may claim this sort of distinction.

Wynn and Starr Face Brick

BACK in the dawn of recorded history, the Chaldeans were known to practice the art of working clay and baking it in the sun into hard, durable properly-sized bricks. We do not know when they learned to convert clay into a hard building substance. But we do know that today brick still is recognized as a premier building material.

Wynn and Starr Face Brick is a product of years of uninterrupted experience in best meeting the particular needs of the builder and planner for such a product.

It combines a quality of texture and character of appearance that offer unlimited choice in adapting to individual desires in the way of architectural design.

Durable, tough, impervious, tightly moulded, properly burned, Wynn and Starr Face Bricks afford every possibility for artistic treatment, being obtainable in a wide choice of harmonious colors.

Face Brick Bonds

IN the old days, and indeed up to comparatively recent times, brick bond was used only structurally, that is, to secure the strength of the wall as a solid mass, but in the seventeenth century European builders began to see an artistic possibility in the bond as it appeared on the surface. They began to see the fine tracery of the mortar joint running over the background of the brick, which could be varied into attractive patterns by different arrangement of the brick bond. As a consequence, there have been developed, in the main, three different types of bond which are used at the present day, with various modifications, to secure attractive effects in pattern.

The first and most obvious of these bonds is what is called Running or Stretcher bond (Fig. 1). The wall surface is made up of stretcher courses, having at the corners a header which appears as a stretcher on the return side. This bond has the merit of being very strong longitudinally, but lacks transverse strength; consequently, it is modified into what is called Common or American bond by laying a course of headers about every sixth course (Fig. 3). As a type or running bond, headers instead of stretchers may be used (Fig. 6). But as the bond is very slight, it should not be laid except for panels or other ornamental effects. For the same purpose the headers may be laid without any bond at all (Fig. 10), in order to secure a reticulated or checkerboard effect.

This method of using headers, as in Common or American bond, in order to secure transverse strength of wall, can be treated in a way to produce very much more pleasing effects, as may be seen in the English and Flemish bonds. The English bond is made up of alternating courses of stretchers and headers (Fig. 2). This produces a very pleasing series of Greek crosses and ripple lines up and down the surface of the wall, and the English brick-builders claim for it the great merit of giving transverse strength to the wall. It, however, has a certain monotony that has lead to a modification which greatly beautifies it as a pattern, by breaking the joints of the successive stretcher courses. This is called English Cross or Dutch bond (Fig. 4) and results in a very attractive pattern in the wall of Greek crosses running in diagonal lines. The Dutch bond differs from the English bond only in the way the corners of the wall are treated.

The Flemish bond (Fig. 7) secures its effect by laying each course in alternate stretchers and headers, the header resting upon the middle of the stretcher in successive courses. This produces a very attractive pattern of dovetailed Greek crosses and is a favorite among builders because of its artistic effect. It also may be modified in various ways by shifting the stretcher or header so as to produce different pattern effects. Thus the Garden Wall bond so called (Fig. 5), is made by laying the courses with from two to four stretchers alternating with a header.

Doorway at Hartsdale, N. Y. Tooker & Marsh, Architects

Face Brick Bonds

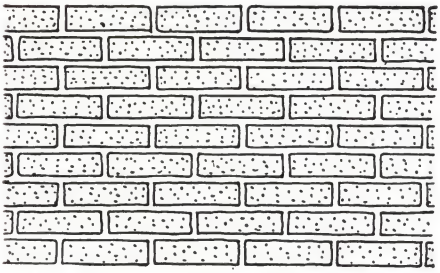


Fig 1. Running or Stretcher.

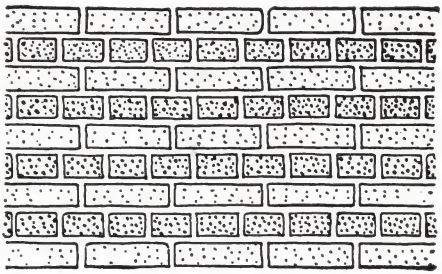


Fig 2. English.

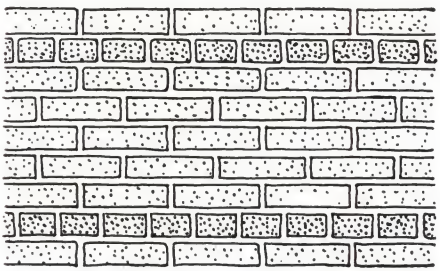


Fig 3. Common.

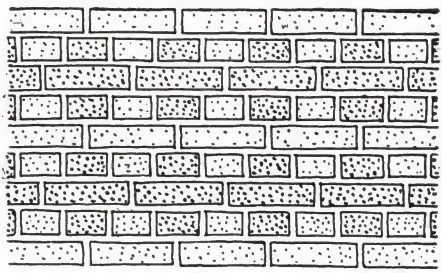


Fig 4. English Cross or Dutch.

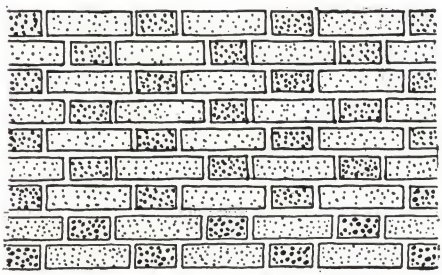


Fig 5. Flemish.

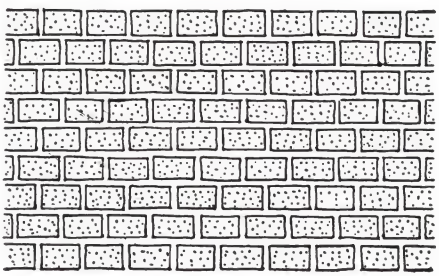


Fig 6. Header.

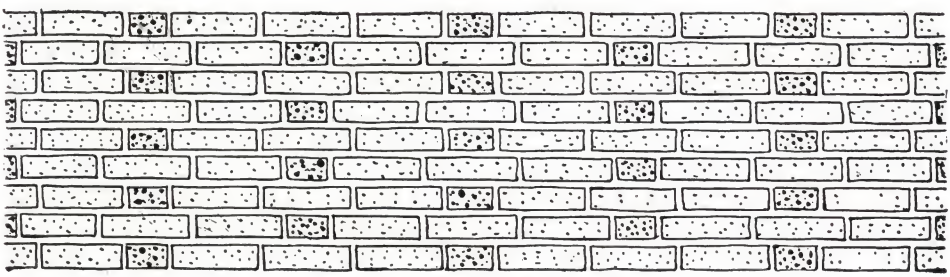


Fig 7. Garden Wall.

Patterns in Brickwork

WITH these three fundamental bonds—the Running or Stretcher, the English, and the Flemish, innumerable other patterns may be made by the simple device of shifting the stretcher or header in successive courses back and forth, always breaking the joint, that is, never permitting two vertical joints to lie in the same line. To illustrate, we give an example of a diamond-shaped pattern which is secured by a modification of the Garden Wall bond (Fig. 8). It is, however, only in case of large wall surfaces that patterns of an elaborate character could be recommended; ordinarily, the three bonds mentioned, with their simplest modifications, will cover all requirements of domestic architecture.

In addition to bonds proper and the patterns that may be woven out of them, there are certain pleasing ornamental effects that may be secured in the wall surface by the arrangement of the brick. Thus for a water table or a sill course the header or the stretcher may be set vertically. Treated in this way headers are called "rowlocks" (Figs. 10, 13, 14 and 16), and stretchers, "soldiers" (Figs. 13-16). For dadoes and friezes or for paneling, especially on large surfaces, patterns of a simple or ornate design may be used (Figs. 8-12). All bond and pattern designs may be greatly modified and enhanced by the arrangement of the color tones in the brick as suggested in Figs. 8 and 9.

Garden Detail, Whitinsville, Mass. Joseph D. Leland, Architect

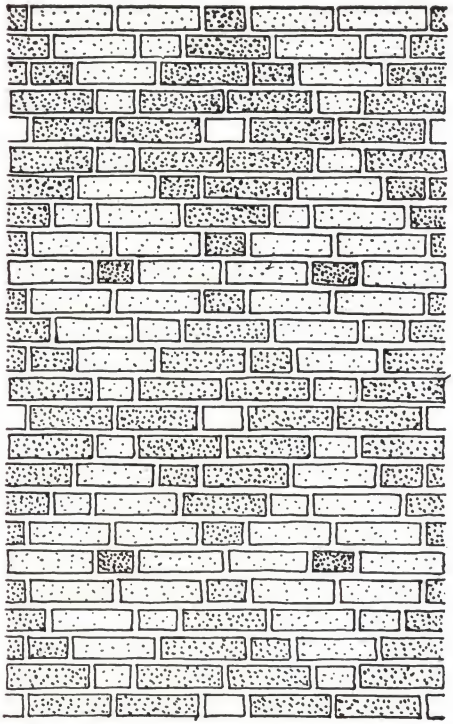


Fig 8.

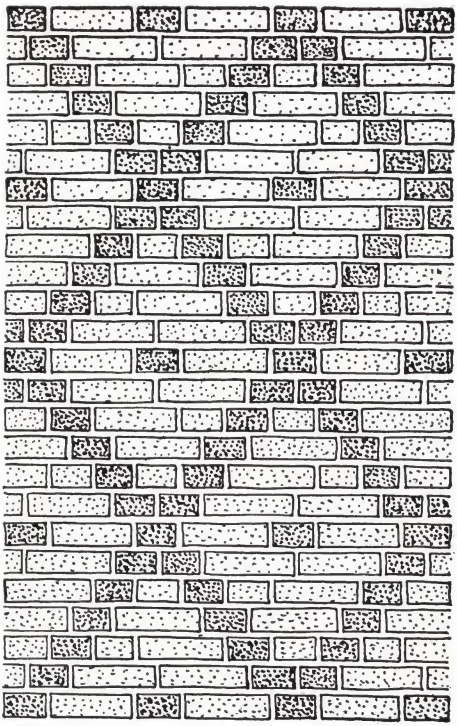


Fig 9.

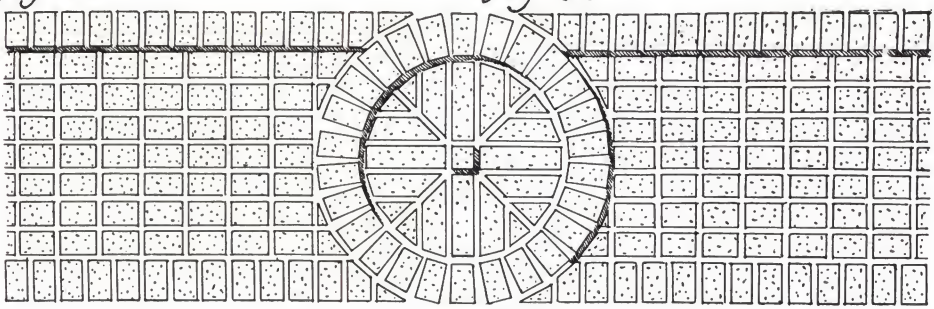


Fig 10.

Face Brick Patterns

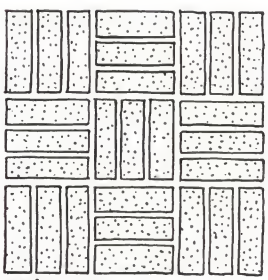


Fig 11.

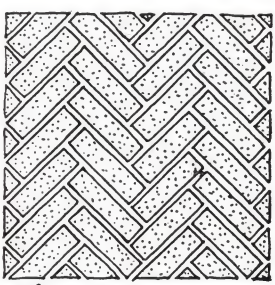


Fig 12.

Mortar Joints

IN examining the bond in a brick wall the eye naturally is first attracted to the brick units as so many colored spots in different pattern effects; but this pattern effect in the brickwork depends very largely upon what at first may be overlooked or disregarded, the mortar joint. The mention of mortar suggests a very commonplace thing which the workman mixes and carries in a hod to the bricklayer, but it is one of the most important elements entering into the beauty, as well as the strength, of a brick wall.

When you consider that all the joints in brickwork, both vertical or "head" joints, and horizontal or "bed" joints, are filled with mortar of one color or another, amounting on an average to one-seventh of the wall, it is evident what a vital part they play in the appearance of the entire wall surface. An artist will tell you that this amount of color introduced into any surface will greatly modify, by contrast or analogy, the general effect, so that it is of the utmost importance, in selecting the sort of brick you wish for your wall surface, that you also select the mortar joint.

Three Elements Involved

Three elements must be carefully considered in dealing with the mortar joints: its color, its texture, and its size and kind. The color of the mortar joint may be such as entirely to destroy the beauty of the brick. On the other hand, if it is properly chosen, it will bring out the fine shades and tones of the brick in such a way as to enhance very greatly their natural beauty. Then, the mortar joint has a certain texture which is produced either by finishing it rough or smoothing it with the trowel or a tool made for that purpose. This mere treatment of the surface of the mortar joint has more to do with the appearance of the wall than one might at first suppose. In addition to that, the size of the mortar joint, running from a thin "buttered" joint up to an inch, naturally affects the color relation of the whole surface; and the kind of joint, whether cut flush, raked out or tooled in various shapes, has a distinct bearing on the whole effect. Never decide on a mortar joint until you thoroughly talk it over with a face brick salesman. He will have valuable suggestions to make. In a word, do not neglect the mortar joint, for it is one of the most important elements that go to make up the beautiful fabric of the brick wall, in the building of which, there is deserved and required the exercise of the very best taste.

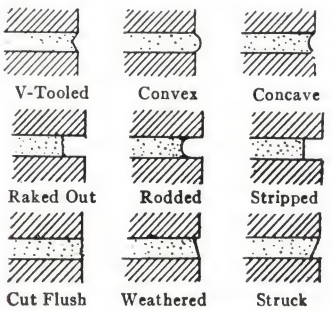


Fig. 17. Mortar Joints

All in all, what with the convenient units of stretcher and header, each with its color and texture, you have a medium in the choice of bond, mortar joint, and pattern for weaving the most charming mosaic or tapestry effects in the wall surface, a possibility offered by no other material than face brick.

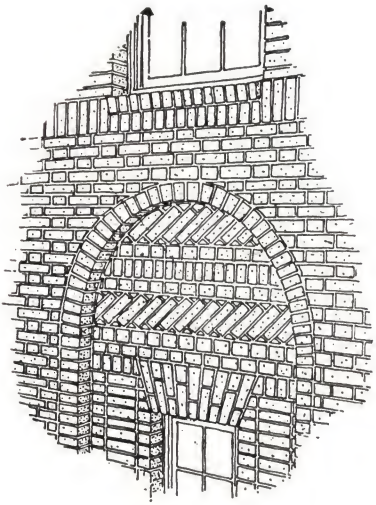


Fig 13.

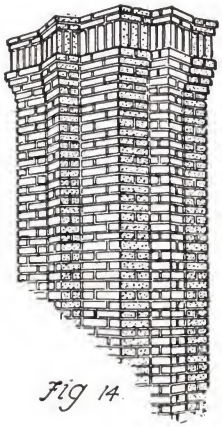


Fig 14

A·F·B·A
USE FACE BRICK
—it Pays

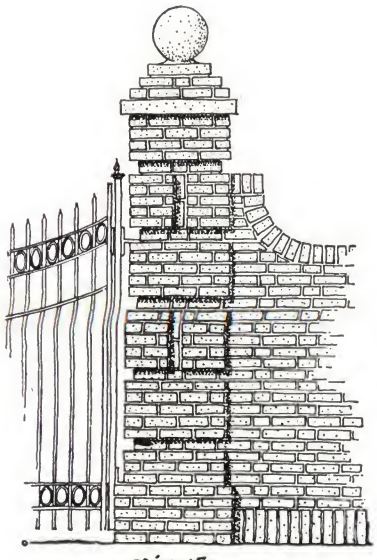


Fig 15.

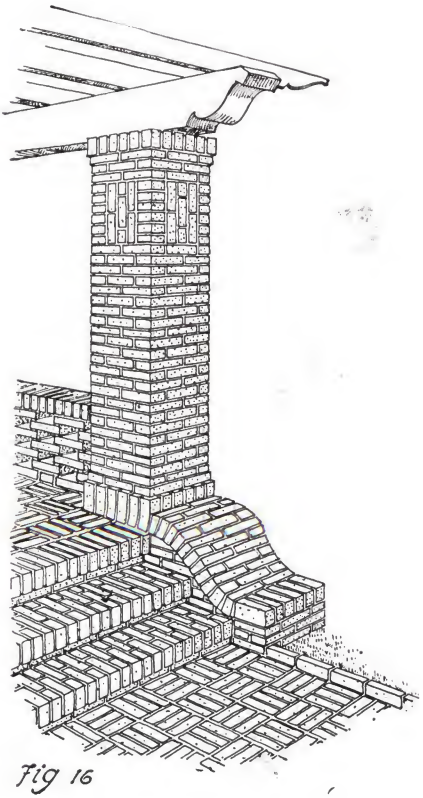


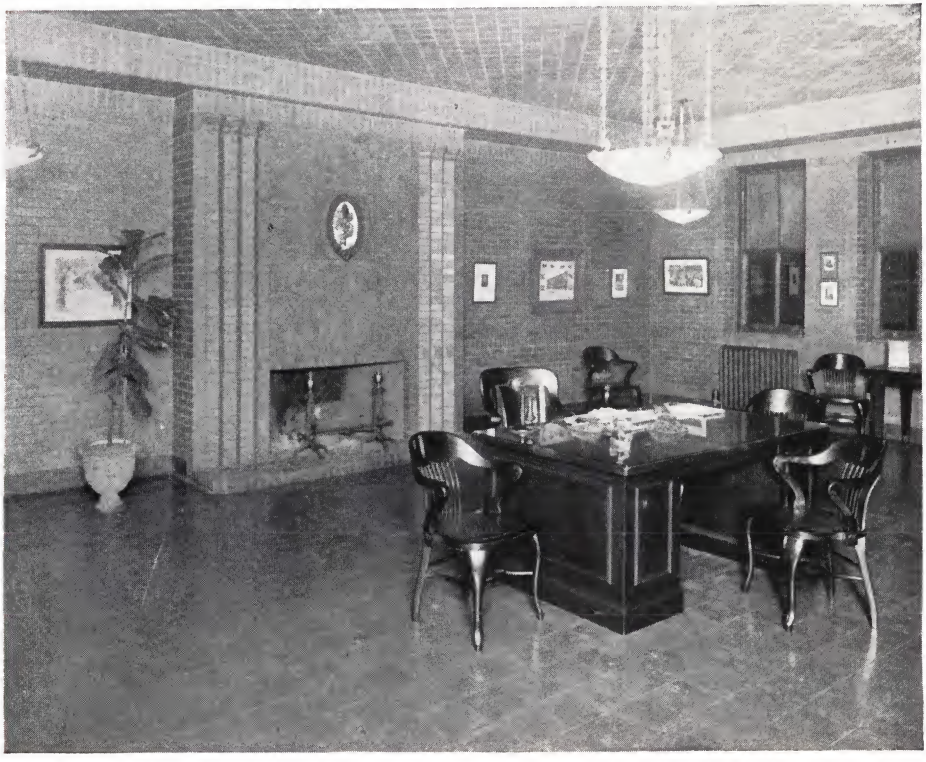
Fig 16

Face Brick Details

Interior Brickwork

YOU perhaps have never thought of brick as used for any other purpose than building a wall, yet face brick are used in a most charming way for the decorative finish of interior wall surfaces. In churches, assembly rooms, school vestibules and corridors, railway stations, great hallways, salesrooms of all sorts, and other public or semi-public places where it is desirable to combine permanence with decorative effects of a light cheerful character, extremely attractive results are secured by the use of smooth or semi-smooth face brick of a pearl gray, golden buff, tan, light bronze, or reddish tone.

For kitchens of all kinds, hospital wards, factory workrooms, or such places as require scrupulous cleanliness, a face brick coated with a salt glaze or enamel is admirably adapted. For some interiors such as club or hotel grills, rich tones of red in roughish textures are most pleasing.



Waterproof Brick Stains

They Restore Faded, Off-Colored and Dirty Bricks to an Even, Natural Brick Tone, With no Painty Effect, and They Waterproof All Bricks

THEY are Stains, not Paints. Paint is not suitable for brickwork because it merely coats the bricks over with a heavy, shiny coat that completely hides the natural texture of the bricks, and this heavy coat grows dull and lifeless in a short time and then cracks and peels. Old paint on brickwork can only be covered by more paint, and the conditions grow worse with every application. The Stains do not coat the surface over, but transparently color it, sinking into the pores of the brick without spoiling the texture. This produces a depth and richness of color that no paint can give, and makes old bricks or poor bricks look like new high-grade goods.

Reasons for Using Brick Stains

The Cost is Very Low

The Stains go further than paint and are more quickly applied. They are cheaper to buy than any good paint, they cover much more surface per gallon than paint, and a workman can do from twenty-five to fifty per cent. more surface per day than with paint.

Waterproofing

The Stains are much more thoroughly waterproof than any paint, and this is of the greatest importance for the ordinary brick wall. Most people do not realize that bricks will absorb a large amount of water. Our Waterproof Brick Stains give you protection against this and are the only materials that combine the natural, brick-texture coloring with thorough rainproofing.

Making Uneven Brick Walls Uniform

When additions are built on brick buildings—houses, factories, or warehouses—the new brick seldom matches the old and the result is unsightly. Our Brick Stains will make the whole surface look alike, and in a natural-brick tone that doesn't seem painty, but as if the whole building had been built at the same time and of the same brick.

Colors. The regular colors are Light and Dark Brick Red, Terra Cotta, Cream, Brown, and White—but almost any other colors or shades can be furnished when desired.

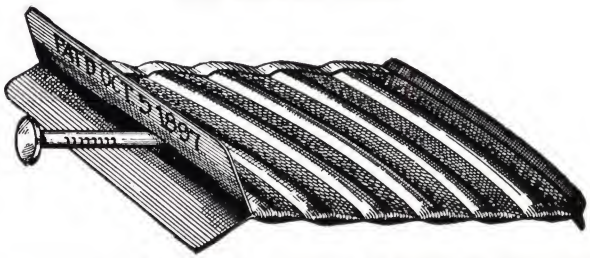
Covering Capacity. One gallon will cover about 200 square feet, two coats, on rough brick, and proportionately more on smoother bricks.

Directions for Application. Apply with a brush, like paint. Apply to a dry surface only. Two coats should be used for most durable results.

Metal Wall Plug

Made Only in One Size, Which Covers All Situations

Size, 2⅜ x 2⅞ inches



THE old methods of fastening woodwork to brick or stone walls are as follows: Nailing into the mortar joints; nailing into wooden plugs driven into holes drilled in mortar joints; nailing into laths set in the joints during construction; and nailing into wood brick built into the walls. Nailing in mortar joints is bad on the face of it, for the mortar possessing no elasticity, crumbles and gives no hold to the nails. Plugging with wood to afford a nailing base for furring, etc., was the best of the old methods, but was open to the following objections: Cost, uncertainty, and lack of durability.

Cost. Because of the time required to drill a hole in the mortar joint, shape the plug, drive it in as far as it will go, then saw it off.

Uncertainty. Because the plug might not be thoroughly dry when put in, so would shrink in drying and become loose in the hole, also the nailing surface of the plug being but ¼ to ⅜ inch thick, the chances of splitting were very great.

Perishability. Because, presuming the plug to be tight and not split by the nail, the lack of air circulation or the dampness of the outer wall would dry or wet-rot it in a comparatively short time.

Laths set in the joints during construction is, at the best, a slovenly way of attaining the end; they soon become loose through shrinkage, weakening the wall by reason of a space ¼ inch wide by 2½ to 3 inches deep, and the thickness of a lath affords a very meager nailing base. This method is condemned by the majority of architects.

Wood brick built in the walls are wet by the mortar when set in and afterwards dry out, so are liable to shrink or rot, and weaken the wall, the only excuse for their use is the lack of a better method.

The case presented for your judgment is whether the use of the Metal Wall Plug, at less cost and with guaranteed security, should not be given the preference over wooden plugging, which costs more and is always uncertain in its holding qualities.

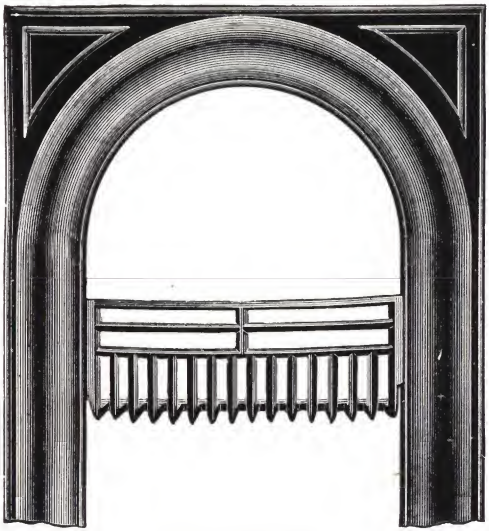
First. The cost of the Metal Wall Plug is small. It holds the nail as firmly in place as it is itself held in the mortar joint; once in, it is there to stay, as it does not shrink or rot.

Second. The wood plug, in place, costs in labor not less than two and one-half cents, and the uncertainty of the results obtained is too well known to need elaboration; it shrinks or rots and becomes loose in the joint.

No architect, engineer or contractor can deny that a perishable material, such as wood, set in an otherwise solid piece of masonry, is a source of weakness and is poor construction.

A great many contractors use them, whether specified or not, finding it economical to do so.

Grates and Fronts



Japanned Finish

Round Grate and Front

For Hardwood or Slate Mantels

Carried in stock. Also Grate Baskets, which are sold separately by the pound.

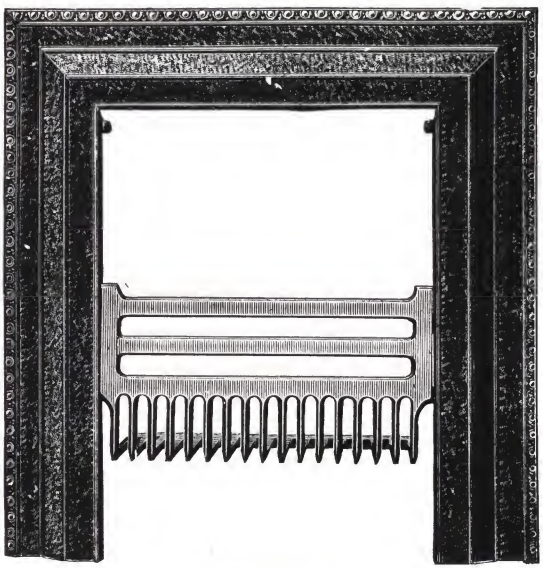
No.	Grate	Height	Width
E	18	34¼	29¾
F	20	32¼	31¾
G	22	34¼	33¾
H	24	34¼	34½

Square Grate and Front

For Hardwood or Slate Mantels

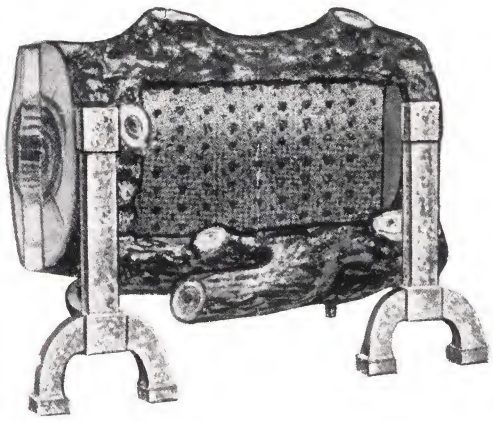
Carried in stock. Also Grate Baskets, which are sold separately by the pound.

No.	Grate	Height	Width
Q	18	29¾	28½
R	20	32⅛	30½
S	22	32⅛	33
T	24	32⅛	34⅞



Lead Finish

Brilliant Gas Log



BEAUTIFULLY designed and scientifically constructed the Brilliant Gas Log will burn on less pressure, use less gas and give more heat than any other heater on the market.

They are guaranteed satisfactory in every respect. They do not lose their decorative appearance. The tubes will not discolor from heat, making it at all times as attractive as when first installed. Adapted to any fireplace, they cut your gas bills to a minimum. One minute after lighting they give out a radiant, penetrating heat.

Comes complete for installation with the exception of the andirons.

18 inch, 7 tube	$26.00
24 inch, 10 tube	30.00
26 inch, 11 tube	33.00
30 inch, 13 tube	40.00

How to Install This Heater

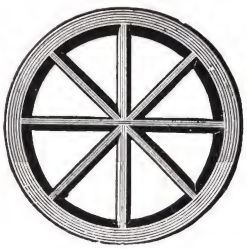
The Cast Iron Rest that comes with each heater is first set in place; then place the log on the rest; care being taken in so doing. See that the metal plate at the bottom of the log is evenly divided on the rest.

The two small holes at each end of the cast plate are for the support of the burners; care should be taken in lighting this burner to the plate so that the burner when set will be evenly supported at each end. See that the lugs on the cast rest are placed to the front of the log; these lugs are to support the loose branch. When connecting the gas line to the burner, be sure that the gas supply line is on a direct line with the inlet on the log or burner, so there will be no twist or pull on the burner when tightening the gas fittings. In placing the clay tubes place the top first in the groove at the top of the opening of the log, and see that the bottom of the tubes are directly over the flame. Each burner has a gas and air adjustment to meet all conditions of gas pressure.

Sewer Pipe Gratings

Four Spoke
4, 6, 8 and 9″ in diameter

Closed Spoke
3, 4, 5, 6, 8, 9 and 10″ in diameter

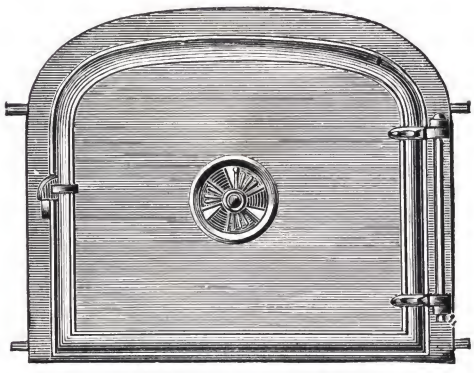


Eight Spoke
4, 6, 8, 9 and 12″ in diameter

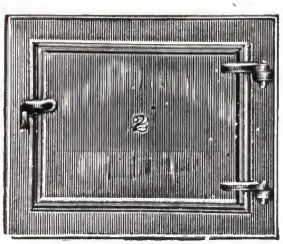
Oven Doors

SIZE

About 12″x15″ in the opening.



Ash Pit Door

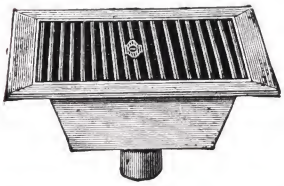


SIZES

8″x10″
12″x14″

Bell Traps

Square Trap

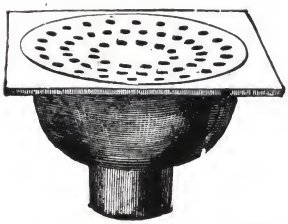


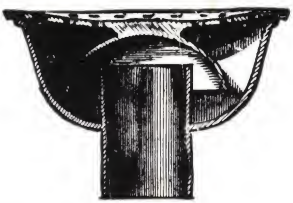
Size, 14¼x14½ inches, outside measurement. 12″x12″. Weight 16½ Lbs.

Heavy Stable Trap

14½x14½x10. Strong enough to drive over.

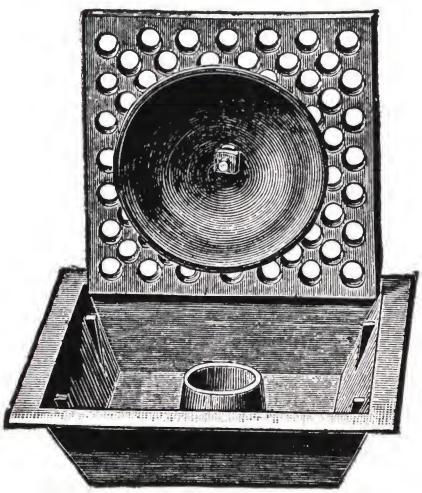
Oval Bell Trap





Size, 12½x12½ inches, outside measurement.

Cellar Floor Trap



Size, 9x9x2½ inches deep.

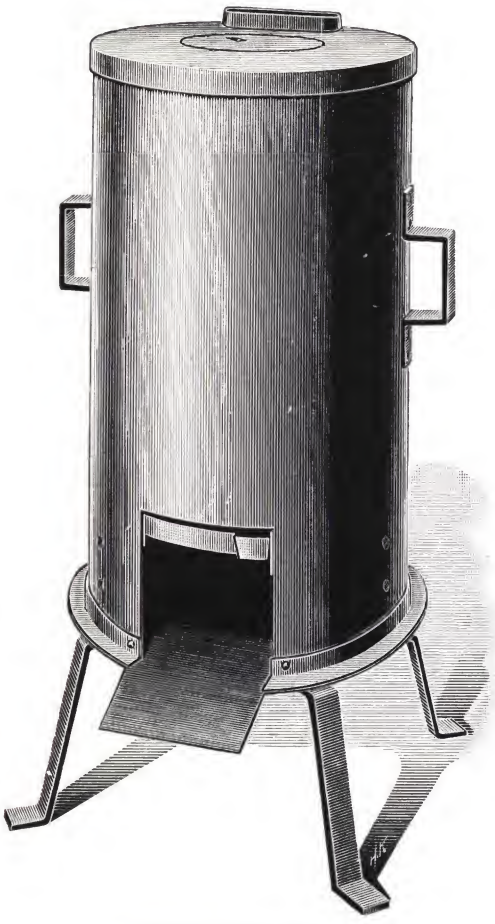
Stench Trap

Or Small Cellar Floor Trap

Top 6 inches square. Cover lifts upon a hinge.

Houston Salamanders

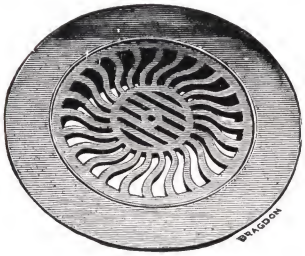
For Hard and Soft Coal and Coke



WITH INSIDE LINING

The top is Cast Iron and takes a 6-in. stove pipe
Grate is of Cast Iron

THERE are five different sizes of these Salamanders, one of which is illustrated. The modern up-to-the-minute contractor knows from experience the value of Salamanders in building work. Houston Salamanders are constructed to give lasting service and will stand hauling and handling from job to job with a minimum of wear.



Sidewalk Coal Hole Covers

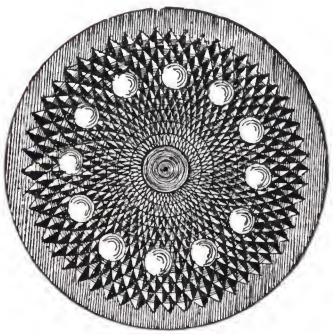
16″ opening. Weight 100 to 125 lbs.
Solid or open cover.

Metal Flue Rings

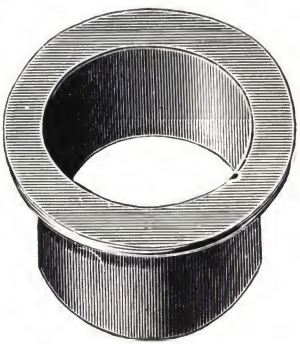
Size 5″ diameter for 5″ stove pipe
Size 6″ diameter for 6″ stove pipe
Size 7″ diameter for 7″ stove pipe
Size 8″ diameter for 8″ stove pipe

Coal Hole Lights

With and Without Glasses

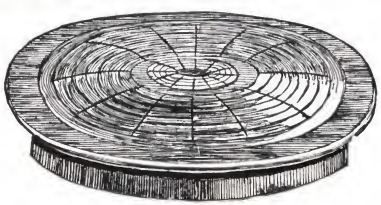


Coal Hole Light



Thimble

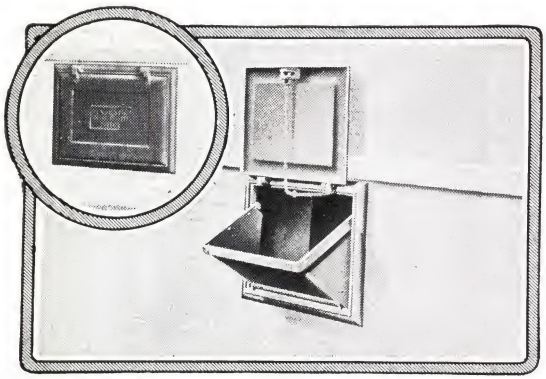
Outside Diameter	Size of Opening	Depth of Thimble	No. Glasses
24 inches	18½ inches	3 inches	12
24 inches	18½ inches	3 inches	None
22 inches	17 inches	3 inches	None
22 inches	17 inches	3 inches	9



Round Cistern Top

Outside Diameter	Size of Opening	Depth of Thimble	Weight
20 ins.	17 ins.	4 ins.	40 lbs.

Majestic Coal Chute

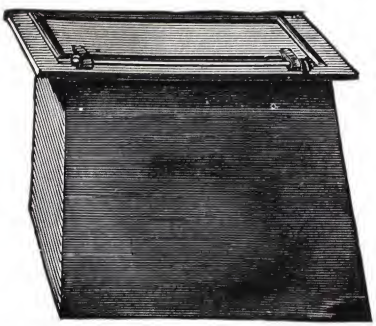


THE Majestic Coal Chute brings to the home owner or builder a convenience that fills a long-felt want. Heretofore every delivery of coal meant further damage to the building and premises —the foundation and window casing becoming more and more disfigured and scarred.

Now thanks to the Majestic Coal Chute, you save the building from damage. The Majestic gives both a window and coal chute, yet costs no more. It can be installed in a new building or one already built.

It not only adds to the looks of the building but lessens the depreciation of property. It is made in a number of sizes suited to any type of building. Made extra durable of cast semi-steel and boiler-plate construction. Unlocked from the inside by pulling an extended chain—no crawling over dirty coal.

Cast Iron Coal Chutes For Cellar Walls



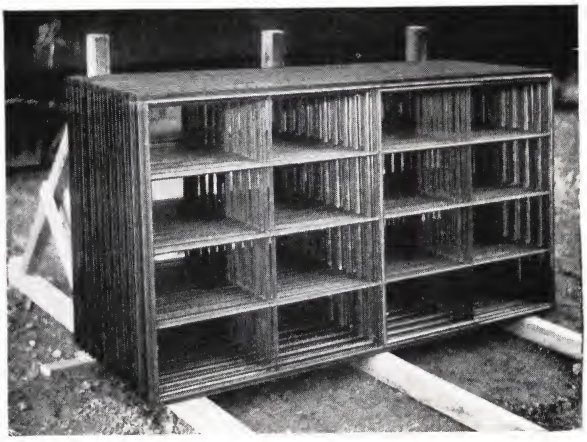
Obtainable in cast iron and wrought iron.

Sizes in cast iron: 16 inches x 16 inches. 18 inches x 18 inches.

Sizes in wrought iron: 16 inches x 16 inches. 18 inches x 18 inches. 20 inches x 20 inches.

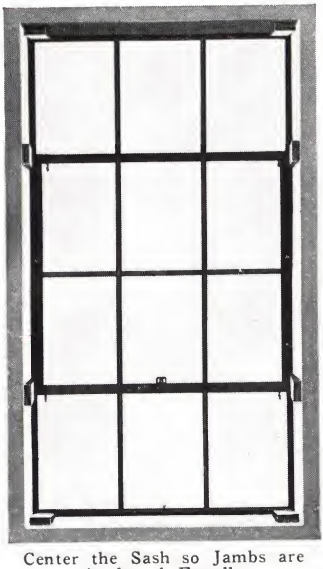
Special sizes made to order in wrought iron only.

Steel Window Sash



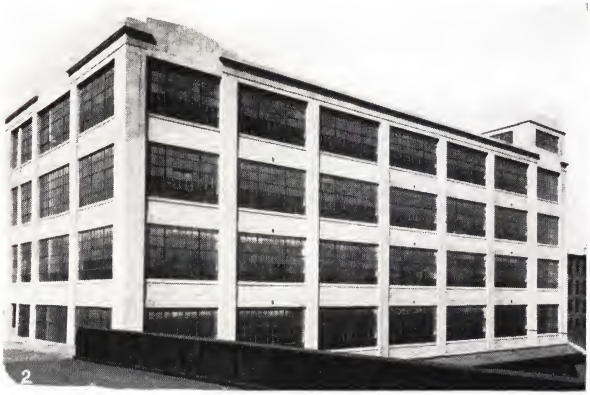
Proper Method of Stacking Windows when Received at Building Site

THE modern science of factory management is now turning its attention very seriously to the human element as the most important factor in production. In the past, machines and the processes of production received first attention. The pioneer work of efficiency engineers has concerned such subjects as rate of lathe speed, position of tools, elimination of unnecessary movements on the part of operators, etc.



Center the Sash so Jambs are Anchored Equally

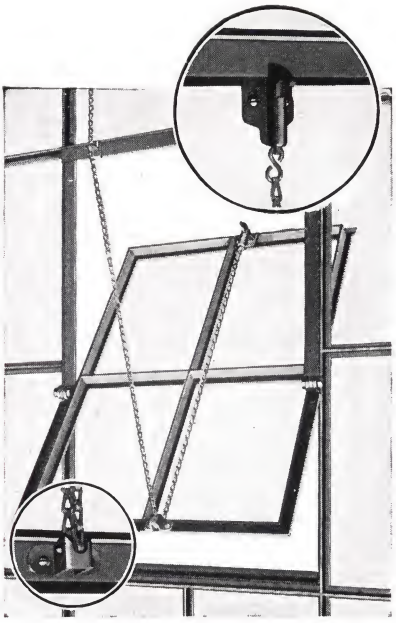
As the study of human efficiency becomes developed, it will naturally divide itself into two parts. One will concern itself with those means of increasing efficiency which are brought directly and consciously to bear upon the employees. The second will consist of those elements favorable to productive efficiency which are brought to bear upon the employees quietly, unobtrusively, without the need of their conscious attention.



Crompton & Knowles Loom Works, Worcester, Mass.
Archs. and Engrs., Aberthaw Construction Co.

Highland Park High School, Highland Park, Mich.
Arch., Wells D. Butterfield; Contrs., Bryant & Detwiler

Monon Route Car Repair Shops, Lafayette, Ind.
Chief Eng., A. S. Kent; Contr., A. E. Kemmer

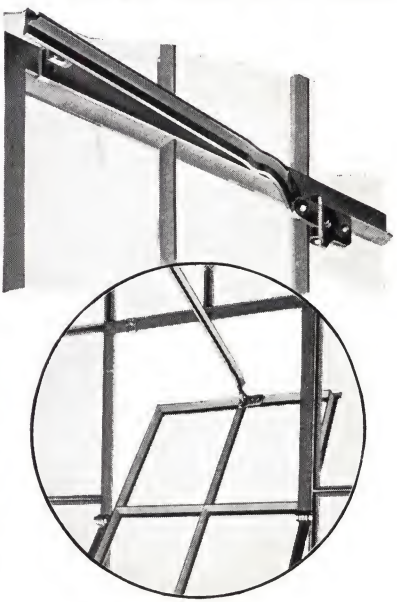


Consideration of the human element in production must start with the factory building itself. It must be so designed as to accommodate the necessary machinery and its accessories, with due regard to convenience of taking in raw material, production, routing, assembling and shipping the finished product. A successful factory building, in other words, has certain characteristics which in themselves promote the welfare and health of the employees, or add to their satisfaction in their work, or otherwise favorably influence their morale.

Undoubtedly the first and most important factor is the amount and character of the light itself.

There is no element in the factory building so valuable in its effect as daylight, yet its value and its application are not by any means fully understood.

The results of adequate daylight in factories are listed by a recent writer on the subject as follows: Unconsciously increased output; finer and more accurate work; less rejections by inspectors; improved morale of the force; more carefully kepted books, machines, instruments, and so forth; less lost and mislaid material; fewer avoidable accidents; less sickness, colds especially; less cost for artificial lighting.



The adequate ventilation of factory buildings is also an important element in efficiency and is normally an accompaniment of daylight. For the steel sash used in modern industrial plants are provided with ventilators which permit an ample supply of fresh air.

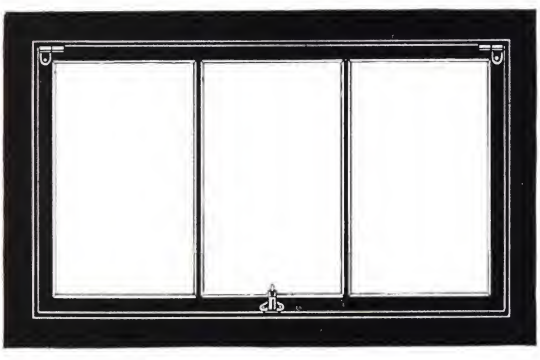
Basement Steel Sash and Frame

STEEL Sash and Frame for Basements are adaptable to any residence or apartment. They are easy to install, requiring no fitting of sash or frame, no locks or hinges, no extras whatever.

But more than that, they combine durable, rugged construction with a caliber of material that means an indestructible basement window. They do not swell, warp or stick. They are easy to open or close. There are no chinks or crevices to be filled with rags or paper to keep out wind, rain or snow.

Labor cost is cut to a minimum and any type of foundation is suitable — concrete, brick or stone.

Clean cut in design, much more attractive than unsightly, continually warping wood frames, they never need repairs.



Magnesite Stucco

THE majority of houses intended for homes are built for people of moderate means, who have had no practical experience in construction. They may have quite definite ideas as to the size and arrangement of the rooms they desire, but usually very little thought is given the important question of exterior wall construction. This most vital element of permanence and economy in upkeep is often overlooked. Their object and desire is to obtain as much convenience, comfort and attractiveness as may be possible with the amount they have to invest. Kellastone meets these requirements. It expresses beauty and refinement, is substantial in appearance and is the equal of stone and brick surfaces in durability.

Frame houses are the cheapest to build but the most expensive to maintain. Their maintenance cost multiplies as the years advance and in like proportion there is a decrease in value.

Granite or stone structures are the most durable and the cost of maintenance the lowest, but their heavy initial cost limits them to people of large financial resource. Nevertheless many who can afford stone or granite construction have been influenced by the beauty and architectural adaptability of Stucco to decide upon its use for the exterior of their homes. One of the greatest demands in the building line today is for absolutely fireproof exterior buildings that approach stone and granite in durability and low cost of upkeep and whose initial cost is not so much in excess of that of frame buildings as to be prohibitive. Kellastone Stucco more nearly fulfills this demand than any other exterior wall surfacing.

Fireproofness

Magnesite is one of the most fire resisting materials known. It is used to line the great furnaces in steel mills, blast furnaces and smelters throughout this and other countries. The tremendous heat required to melt steel, iron, copper and similar ores, into a running molten mass does not destroy, and has but slight effect on the magnesite furnace linings and beds. No further proof of the fire-resisting properties of magnesite is necessary.

The other principal ingredient, magnesium chloride, is an efficient fire-extinguisher. Wood that has once been saturated with it cannot be ignited.

Adhesiveness

Magnesite Stucco is applied over dry surfaces, will bond or stick so tenaciously that separation is almost impossible. In fact, the bond is so perfect that the two materials really become one. The value of this characteristic of firmly attaching itself to surfaces over which it is applied, is fully recognized by architects and contractors who have had to rely wholly upon suction or keying, to hold other plastic materials in place.

Resilience

At the time of discovery of oxychloride cement by Sorel, its flexibility and resilience attracted much attention. It was found that this material not only possessed an exceptional amount of rebound, but that it could actually be bent or deflected two inches in a span of six or seven feet without cracking or damage; also that it could be bent and rebent repeatedly without breaking. The remarkable characteristics of immunity to expansion, contraction and the resilience of magnesite compositions, have been conclusively proven by tests and investigations conducted by a number of leading universities and engineers' societies.

Expansion and Contraction

Magnesite Stucco is so slightly affected by temperature changes after it has hardened, that, from a practical viewpoint, it may be termed to be immune to expansion and contraction.

Insulation

Magnesite Stucco is an excellent non-conductor. It does not readily transmit heat, cold, electricity or sound. Men who are practical in the building industry recognize the insulating value of magnesite, especially when combined with asbestos.

The most successful and efficient pipe coverings are made of magnesite. Notwithstanding its higher cost, it is rapidly displacing other materials used for insulating purposes. It has been used with equal success as an insulation for large refrigerating chambers.

The economic worth of a stucco possessing such unusual insulating qualities, cannot be over estimated. It repels cold in winter, thereby making the home more comfortable and effecting a saving in fuel. It repels the heat of summer and makes the home cooler. Furthermore, in a large measure it prevents the dampness that is so frequently experienced in houses of brick and cement block construction. By using Magnesite Stucco you get a warm, dry house in winter and a cool, comfortable one in summer.

Utility

Magnesite Stucco may be applied over surfaces of new and old painted brick, hollow building tile, stone, cement blocks, roughened concrete, wood lath, galvanized metal lath, and various forms of stucco board and patent lath. It will not only produce beautiful and distinctive architectural effects in new buildings but is ideally adapted for remodeling and overcoating old structures. It will make them modern and attractive and give them a substantial and stonelike appearance. It may be stated without qualification, that no other building material is so well adapted to produce permanent results for remodeling purposes at a reasonable expenditure.

Proper Care

Magnesite Stucco should be stored in a clean, dry building, sheltered from the sun, not exposed to dampness, but ventilated in extremely hot weather to avoid excessive heating. The walls and floor of the storage room should be lined with a clean building paper and the floor raised clear of the ground to avoid the harmful effects of moisture. On damp, rainy or foggy days, doors and openings should be closed to prevent mist or dampness reaching the product. If room permits, it is best not to pile the bags too high. Excessive weight has a tendency to compact and cause the material to lump.

Composition Flooring

COMPOSITION FLOORING is composed of materials in powder and liquid form. A chemical reaction takes place when these materials are mixed and spread and all the ingredients combine into a tough, seamless mass. It is installed in two coats: an under, fibrous coat of great strength and pliability and a top coat of exceedingly fine grained texture, highly immune to abrasive wear under the severest conditions. The combination of the two coats produces a floor of quietness, strength and elasticity which will stand considerable settling strain without cracking. It can be laid on bases of concrete, wood or steel to which it has remarkable properties of adhesion.

Composition Flooring can be laid with borders, in designs and in terrazzo effects.

Because of the lightness, warmth, resilience and quietness of Composition Flooring and its adaptability to heavy trucking and machinery vibration (which terrazzo, tile and similar materials will not stand) and its sanitary qualities, it covers a wider range of practical adaptability than any other form of flooring. On this account, it is largely used in schools, theatres, hospitals, asylums, office buildings, public buildings, machine shops and manufacturing establishments.

National Stucco-Plaster Fabric

NATIONAL STUCCO-PLASTER FABRIC is a galvanized, welded wire fabric, designed as a reinforcement and a base for Portland Cement and magnesite exteriors, either new or overcoat.

It is manufactured of either No. 14 or No. 12 gauge cold-drawn galvanized-steel wire, which develops a tensile strength of more than 60,000 pounds per square inch of steel. The fabric is furnished in 2" x 2" or 2" x 4" mesh, all wires being electrically welded at the intersections.

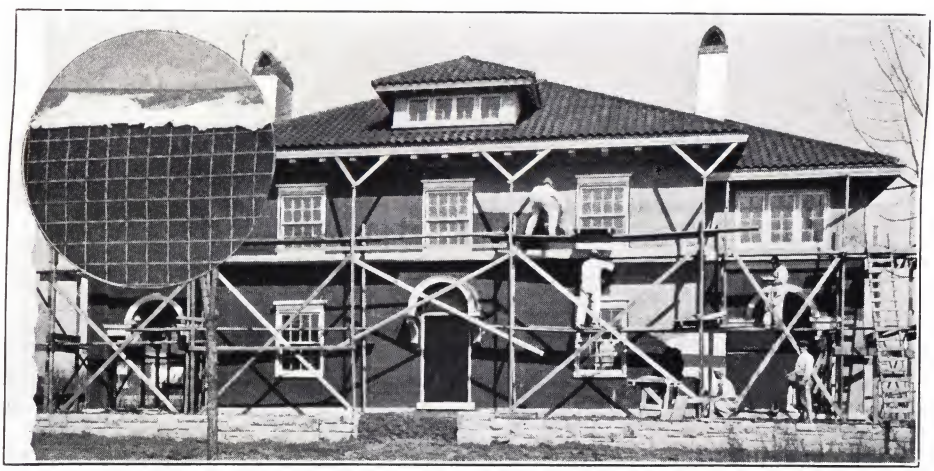
The crimps make National Stucco-Plaster Fabric self-furring, and serve to hold it a uniform distance from the background. When the plastic material is applied, the wires become thoroughly embedded, the result being a monolithic construction of very high tensile strength.

As the gauge of the wire is many times heavier than that used in any type of expanded metal or wire lath, and, as there are no "keys" formed, it is a physical impossibility for the surface to come off unless it takes the fabric with it.

National Stucco-Plaster Fabric has equal reinforcing value in all directions; it equalizes the stresses engendered in the stucco slab during the period of shrinkage and thereby prevents cracking.

There are ten reasons from the plaster contractor's point of view why National Stucco-Plaster Fabric is the most economical and permanent background for stucco exteriors, either new or overcoat:

1. It is easy to apply—it requires no furring strips.
2. It is galvanized—therefore it is permanent; will not rust or corrode.
3. It eliminates "keys"—which have no structural strength.
4. It gives a reinforced, monolithic stucco exterior—because the fabric develops a tensile strength of more than 60 000 pounds per square inch of steel.



J. C. Nichols Co., Country Club District, Kansas City, Mo., Edward W. Tanner, Architect, Kansas City, Mo., H. Stanley Hill, Plaster Contractor, Kansas City, Mo.

National Stucco-Plaster Fabric

5. It requires 10% less material than wood lath.

6. It requires 25% less material than metal lath.

7. It is as easy to work over as wood lath.

8. It automatically insures sufficient "grounds" (the proper thickness of stucco) to give a serviceable and lasting job.

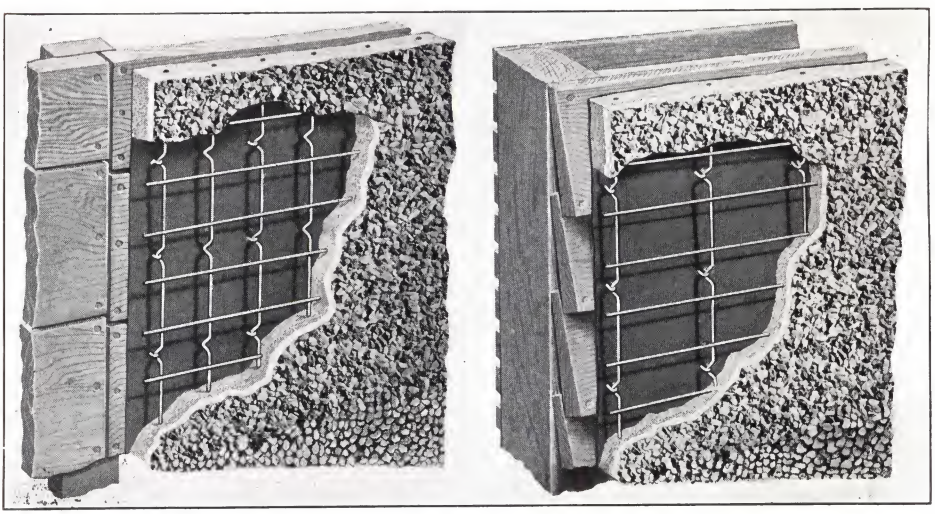
9. It costs no more in place than ordinary metal and wood lath or plaster board stucco bases.

10. National Stucco-Plaster Fabric saves time, labor and material. Contractors who have once tried it will use no other for any job, large or small, new or overcoat.

Welded **STOCK STYLES** **Galvanized**

Style	Mesh	Gauge of Wires Long.	Trans.	Weight lbs. sq. yd.
C-212	2″ x 2″	12	12	3.5
C-214	2″ x 2″	14	14	2.
C-412	2″ x 4″	12	12	2.6
C-414	2″ x 4″	14	14	1.5

(C-) With ⅜″ Furring Crimp. Rolls contain 100 square yards. Width of Fabric, 48 inches. Length of Roll, 225 feet. One inch round head galvanized staples are used to fasten the fabric to the wall.



Section of National Stucco-Plaster Fabric applied to the sheathing of a new house. The fabric shown is Style C-212, composed of No. 12 gauge wires on 2″ centers.

Note how the National furring crimp spaces the fabric from the clapboards, on an over-coating job. Style C-412 fabric, composed of No. 12 gauge wires on 2″ x 4″ centers.

River Sand

WASHED River Sand from the Allegheny River is unquestionably one of the best building sands in the country. Nothing better can be found for lime mortar or cement work. Nature was very kind in placing this great boon at our disposal. It has been instrumental in our city's growth, as a large city without a good building sand is greatly handicapped. Prices on carloads quoted upon application.

River Gravel

In washing or screening the sand from our river the pebbles or gravel are taken out and used for cement concrete gravel roofing and building purposes. In this immediate vicinity it is more economical for concrete work than broken stone and the best authorities consider it equally good.

White Sand

Used for finishing coat in plastering and for fine, pressed brick work. It is a crushed rock sand, washed with water to take out the impurities. Local shipments made in sacks, barrels and carloads in bulk.

Marble Dust

For Cement and Plaster Work

Ground White Marble—packed in 150-pound cloth bags—used for plastering and other building purposes. Stock on hand at all times.

Limestone Dust

For Cement Work

A solid stone product especially adapted for top coat of cement sidewalks. This should be used in preference to any other material.

Lath—Wood

Hemlock and Pine Plastering Lath, 4-foot lengths, standard manufacture, carried in stock.

Asbestos Cement

A material used for repairing backwalls in stoves, furnaces, etc. Most excellent for any repairs where heat is used. Packed in 150-pound cloth bags, and ready to use with the addition of water. Can be furnished in several different grades.

We also carry in stock Asbestos Fibre for various purposes.

Sash Weights

Iron and lead sash weights of usual size and weight can be shipped at all times from Pittsburgh stock. Special sizes and lead weights made to order.

Plumbers' Oakum

We carry in stock Oakum suitable for plumbers' and sewering contractors' purposes. Packed in bales of 50 pounds per bale. Spun ready for use.

Allegheny River Sand and Gravel

Pittsburgh Sand averages about 2700 lbs. to a cubic yard. Pittsburgh Gravel averages about 2800 lbs. to a cubic yard.

Weights and Measures

Avoirdupois

Gross ton	Cwts.	Pounds	Ounces
1.	20.	2240.	35840.
0.05	1.	112.	1792.
.....	.0089	1.	16.
.....	.....	0.0625	1.

Long Measure

Miles	Rods	Yards	Feet	Inches
1.	320.	1760.	5280.	63360.
0.003125	1.	5.5	16.5	198.
0.000568	0.1818	1.	3.	36.
0.0001894	0.0606	0.3333	1.	12.
0.0000158	0.005051	0.02778	0.08333	1.

Square or Land Measure

Square Miles	Acres	Square Rods	Square Yards	Square Feet	Square Inches
1	640.	102400.	3097600.	27878400.	.....
.....	1.	160.	4840.	43560.	6272640.
.....	.....	1.	30.25	272.25	39204.
.....	.....	0.0331	1.	9.	1296.
.....	.....	.....	0.111	1.	144.
.....	.....	.....	.....	0.0069	1.

Cubic or Solid Measure

Cubic Yard	Cubic Foot	Cubic Inches
1	27.	46656
....	1.	1728

Dry Measure

Struck Bushel	Pecks	Quarts	Pints	Gallons
1	4	32.	64.	8.
....	1	8.	16.	2.
....	....	1.	2.	0.25
....	....	0.5	1.	0.125
....	....	4.	8.	1.

Seed Required Per Acre and Weight Per Bushel

The following table gives weight and average quantity of seed and grain to be sown per acre:

	Weight per Bushel	Quantity Sown per Acre
Clover Seed	60	8 to 12 lbs.
Crimson Seed	60	10 lbs.
Alfalfa Seed	60	20 to 25 lbs.
Alsyke Seed	60	6 to 8 lbs.
White Clover Seed	60	6 lbs.
Timothy Seed	45	10 lbs.
Millet Seed	50	¾ to 1 bu.
Hungarian Seed	48	¾ to 1 bu.
Hemp Seed	44	40 to 60 lbs.
Flax Seed	56	¾ to 1 bu.
Rape Seed	56	8 to 10 lbs.
Blue Grass Seed	14	¾ to 1 bu.
Orchard Grass Seed	14	1½ to 2 bus.
Red Top Seed	14	1 to 1½ bus.
Sorghum for Forage	50	¾ to 1 bu.
Sorghum for Syrup	50	4 to 6 lbs.

	Weight per Bushel	Quantity Sown per Acre
Broom Seed Corn	48	4 to 6 lbs.
Peas	60	2 to 2½ bus.
Beans	60	2 to 2½ pks.
Corn for Ensilage	56	8 to 10 qts.
Corn for Grain	56	4 to 5 qts.
Corn in Ear	68 to 70.	
Wheat	60	1½ to 2 bus.
Barley	48	1½ to 2 bus.
Buckwheat	50	¾ to 1¼ bus.
Rye	56	1 to 1½ bus.
Oats	32	2 to 3 bus.
Dried Apples	25	
Dried Peaches	32	
Potatoes	60	
Bran	20	

Specific Gravity of Various Substances

Aluminum	2.60-2.75	Lead	11.37
Asphaltum	1.10-1.20	Lime, quick	.843
Brass	8.40-8.70	Limestone	2.46-2.84
Brick, hard red	1.53-2.30	Masonry, stone, dry	2.00-2.55
Ordinary Fire Brick	1.40-2.00	Masonry, brick, dry	1.50-1.60
Cement, Portland	3.10-3.20	Oak, dry	.69-1.03
Charcoal	.44	Pine	.35- .60
Clay, dry	1.80-2.60	Quartz	2.5 -2.80
Coal, bituminous	1.20-1.50	Sand, fine, dry	1.40-1.65
Coal, anthracite	1.40-1.70	Sand, wet	1.90-2.05
Coke, loose	.55	Sand, coarse	1.40-1.50
Concrete	2.47	Sandstone	2.20-2.50
Copper	8.78-9.00	Steel	7.26-7.86
Earth	1.30-1.80	Slate	2.60-2.70
Glass, window	2.64	Tin	7.20-7.30
Granite	2.50-3.00	Zinc	6.90-7.20
Iron	7.10-7.50	Water	1.
Iron, wrought	7.79		

Weight of a Cubic Foot of Substances

	Pounds		Pounds
Aluminum	162	Earth, soft flowing mud	108
Anthracite, solid	93	Elm, dry	35
Anthracite, loose	54	Flint	162
Ash, white, dry	38	Granite	170
Asphaltum	87	Gravel	105-120
Brass, cast	504	Hemlock, dry	25
Brass, rolled	524	Hickory, dry	53
Brick, best pressed	150	Ice	58.7
Brick, common, hard	125	Iron, cast	450
Brick, soft, inferior	100	Iron, wrought	485
Brick Work, pressed	140	Lead	711
Brick Work, ordinary	112	Lime, quick	53
Brick, fire	120	Limestone, solid	168
Cement, Natural	60-75	Limestone, broken	80-115
Cement, Portland, loose	100	Oak, live, dry	59
Cement, Portland, packed in bbls.	120	Oak, white, dry	50
Cherry, dry	42	Pine, white, dry	25
Chestnut, dry	41	Pine, yellow, dry, Northern	35
Clay, potter's, dry	119	Pine, yellow, dry, Southern	45
Clay, in lump, loose	63	Plaster of Paris	80
Coal, bituminous, solid	84	Sand, loose, dry	75-105
Coal, bituminous, broken	49	Sandstone	151
Coke, loose	26.3	Shale	162
Concrete, average	125-140	Snow, fresh fallen	5.2
Copper, cast	542	Water	62½
Copper, rolled	548	Water, sea	64
Earth, loam, dry, loose	76	Zinc	437
Earth, loam, moderately rammed	95	Green Timber, ⅕ to ½ more than dry.	

Weights of Sand and Stone—Pounds

Sand and Stone	Cubic Yard	Cubic Foot	Sand and Stone	Cubic Yard	Cubic Foot
Screened and Washed Sand	2,275	84.25	Stone passing 2-inch ring	2,350	87.
River Sand, wet	2,340	86.66	Solid Earth	3,553	.....
River Sand, dry	2,490	92.22	Loose Earth	2,361	.....
Coarse Gravel	2,800	103.70	Solid Quartz	4,455	.....

1 cubic yard solid earth or gravel contains 18 heaping bushels before digging and 27 bushels loose after digging. 1 cubic yard solid stone equals 1-9/10 cubic yard loose broken stone.

Weights and Volume of Coal—Loose or Broken

1 cubic foot of Egg	Coal	weighs 55.6 pounds, or 40	cubic feet to ton.
1 cubic foot of Stove	Coal	weighs 57.5 pounds, or 39	cubic feet to ton.
1 cubic foot of Nut	Coal	weighs 56.7 pounds, or 39.5	cubic feet to ton.
1 cubic foot of Pea	Coal	weighs 64.8 pounds, or 41	cubic feet to ton.
1 cubic foot of Bituminous	Coal	weighs 54. pounds, or 42	cubic feet to ton.

Weights and Measures

TROY WEIGHT

24 grains ..... 1 pwt.
20 pwts. ..... 1 ounce
12 ounces ..... 1 pound

Used for weighing gold, silver and jewels.

APOTHECARIES' WEIGHT

20 grains ..... 1 scruple
3 scruples ..... 1 dram
8 drams ..... 1 ounce
12 ounces ..... 1 pound

The ounce and pound in this are the same as in Troy weight.

AVOIRDUPOIS WEIGHT

27 11/32 grains ..... 1 dram
16 drams ..... 1 ounce
16 ounces ..... 1 pound
25 pounds ..... 1 quarter
4 quarters ..... 1 cwt.
2,000 lbs. ..... 1 short ton
2,240 lbs. ..... 1 long ton

DRY MEASURE

2 pints ..... 1 quart
8 quarts ..... 1 peck
4 pecks ..... 1 bushel
36 bushels ..... 1 chaldron

LIQUID MEASURE

4 gills ..... 1 pint
2 pints ..... 1 quart
4 quarts ..... 1 gallon
31½ gallons ..... 1 barrel
2 barrels ..... 1 hogshead

TIME MEASURE

60 seconds ..... 1 minute
60 minutes ..... 1 hour
24 hours ..... 1 day
7 days ..... 1 week
28, 29, 30 or 31 days ..... 1 calendar month

(30 days=1 month in computing interest)

365 days ..... 1 year
366 days ..... 1 leap year

CIRCULAR MEASURE

60 seconds ..... 1 minute
60 minutes ..... 1 degree
30 degrees ..... 1 sign
90 degrees ..... 1 quadrant
4 quadrants..12 signs or 360 degrees..1 circle

LONG MEASURE

12 inches ..... 1 foot
3 feet ..... 1 yard
5½ yards ..... 1 rod
40 rods ..... 1 furlong
8 furlongs ..... 1 stat. mile
3 miles ..... 1 league

CLOTH MEASURE

2¼ inches ..... 1 nail
4 nails ..... 1 quarter
4 quarters ..... 1 yard

MARINER'S MEASURE

6 feet ..... 1 fathom
120 fathoms ..... 1 cable length
7½ cable lengths ..... 1 mile
5,280 ft. ..... 1 stat. mile
6,085 ft. ..... 1 naut. mile

MISCELLANEOUS

3 inches ..... 1 palm
4 inches ..... 1 hand
6 inches ..... 1 span
18 inches ..... 1 cubit
21.8 inches ..... 1 Bible cubit
2½ ft. ..... 1 military pace

SQUARE MEASURE

144 sq. in. ..... 1 sq. foot
9 sq. feet ..... 1 sq. yard
30½ sq. yards ..... 1 sq. rod
40 sq. rods ..... 1 rood
4 roods ..... 1 acre
640 acres ..... 1 sq. mile

About an Acre. An acre contains 4,840 square yards; 209 feet long by 209 feet broad is 1 acre approximately.

SURVEYOR'S MEASURE

7.92 inches=1 link.
25 links=1 rod.
4 rods=1 chain.
10 square chains or 160 square rods=1 acre.
640 acres=1 square mile.
36 square miles (6 miles square)=1 township

CUBIC MEASURE

1,728 cubic in.=1 cubic foot.
128 cubic feet=1 cord (wood).
27 cubic feet=1 cubic yard.
40 cubic feet=1 ton (shpg.).
2,150.42 cubic inches=1 standard bushel.
268.8 cubic inches=1 standard gallon.
1 cubic foot=about four-fifths of a bushel.

METRIC EQUIVALENTS

Linear Measure

1 centimeter=0.3937 in.
1 decimeter=3.937 in.=0.328 foot.
1 meter=39.37 in.=1.0936 yards.
1 dekameter=1.9884 rods.
1 kilometer=0.62137 mile.
1 in.=2.54 centimeters.
1 ft.=3.048 decimeters.
1 yard=0.9144 meter.
1 rod=0.5029 dekameter.
1 mile=1.6093 kilometers.

Square Measure

1 sq. centimeter=0.1550 sq. in.
1 sq. decimeter=0.1076 sq. ft.
1 sq. meter=1.196 sq. yard.
1 are.=3.954 sq. rd.
1 hektar=2.47 acres.
1 sq. kilometer=0.386 sq. mile.
1 sq. inch=6.452 sq. centimeters.
1 sq. foot=9.2903 sq. decimeters.
1 sq. yd.=0.8361 sq. meter.
1 sq. rd.=0.2529 are.
1 acre=0.4047 hektar.
1 sq. mile=2.59 square kilometers.

Measure of Volume

1 cu. centimeter=0.061 cu. in.
1 cu. decimeter=0.0353 cu. ft.
1 cu. m'r = 1.308 c. y.
1 ster = 0.2759 cd.
1 liter= 0.908 qt. dry. / 1.0567 qt. liq.
1 dekaliter= 2.6417 gal. / .135 peck.
1 hektoliter=2.8375 bushels.
1 cu. inch=16.39 cu. centimeters.
1 cu. foot=28.317 cu. decimeters.
1 cu. yd.=0.7646 cu. m.
1 cord=3.624 sters.
1 qt. dry=1.101 liters.
1 qt. liq.=0.9463 liter.
1 gal.=0.3785 dekaliter.
1 peck=0.881 dekaliter.
1 bush.=0.3524 hektoliter.

Weights

1 gram=0.0527 ounce.
1 kilogram=2.2046 lbs.
1 metric ton=1.1023 English ton.
1 ounce=28.35 grams.
1 lb.=0.4536 kilogram.
1 English ton=0.9072 metric ton.

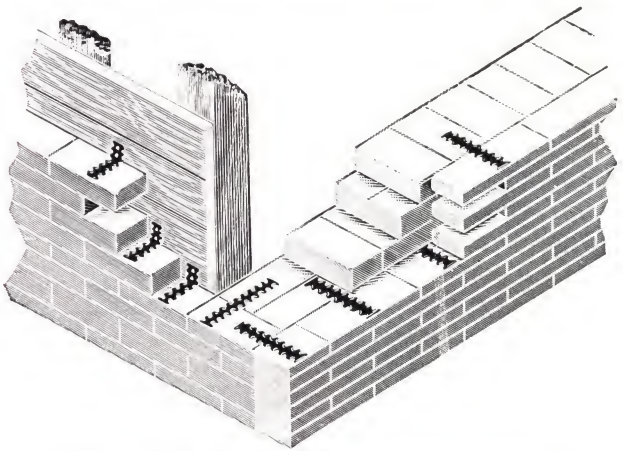
APPROXIMATE METRIC EQUIVALENTS

1 decimeter=4 inches.
1 meter=1.1 yards.
1 kilometer=5/8 of mile.
1 hektar=2½ acres.
1 ster, or cu. meter=¼ of a cord.
1 liter= 1.06 qt. liq. / 0.9 qt. dry.
1 hektoliter=2⅝ bush.
1 kilogram=2⅕ lbs.
1 metric ton=2,200 lbs.

Whalebone Wall Tie

For Face Brick, Veneering, Etc.

Made From Best Galvanized Iron



The Only Tie That Binds. Architects Specify Them

"Standard"

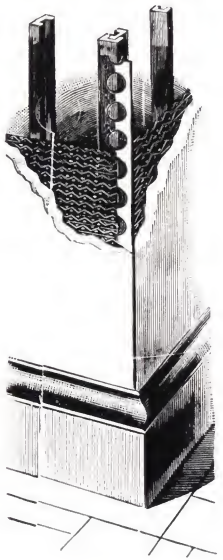
NO more clipping of brick, which is a waste of time and material. The Whalebone Tie insures a perfect bond, and is the most practical and efficient tie for all purposes, making the strongest wall and bond known at the present time.

For Veneering

The Whalebone Wall Tie is the only tie that grips the brick and holds them in place.

Veneering is becoming more popular every day, and where sheathed with building paper, as shown in cut, fills every want, making your home durable, cool in the summer and warm in winter.

Metal Corner Bead for Plastering



IS formed of rolled steel plate folded double and adapted to be placed upon wood, brick, terra cotta, mac-ite or steel.

It is perforated in such a way that the plaster goes through, and thereby forms a solid corner of mortar and steel securely locked together; a steel guard which can be relied upon in any emergency.

How To Use It

On Wood Lath. Grounds that are three-fourths inch would require three-eighths size of bead, as the plaster is three-eighths inch thick; with seven-eighths grounds one-half inch size of bread would be required, as plaster would be one-half inch thick.

On Wire Lath or Expanded Metal. The thickness of plaster shows the size bead required. If grounds are three-fourths inch, the thickness of plaster would be five-eighths inch and the size bead required five-eighths inch. With five-eighths grounds one-half inch would be the thickness of plaster, and one-half inch the size of bead required.

On Brick or Terra Cotta. Grounds that are five-eighths inch would have five-eighths thickness of plaster, therefore five-eighths inch size of bead. It is well in ordering for "Terra Cotta" to have about 10 per cent. of order three-eighths size of bead, no matter what the balance of order requires. This provides for any unevenness in the terra cotta wall.

Weights. One hundred feet weighs 20 pounds in any size.

How To Order

Metal Corner Bead is carried in stock in lengths of 9 and 10 feet, and in sizes of three-eighths and five-eighths inch to suit the thickness of grounds and plaster. Ten lengths to every bundle. If shorter lengths are required, the above named lengths can be readily cut so as to get the length desired.

(Note that the metal corner is erected after the lathing is done and before the plastering is done.)

Houston Wall Board

WALLS and ceilings surround our life, protecting both our homes and business places from storm, wind, cold and heat.

Are they, then, not worth building right?—Walls and ceilings that not only are more tasteful and more artistic, but so built that they are staunch and lasting?—as sturdily constructed as the outside walls.

Houston Board creates—or re-creates—walls and ceilings that remain free from repair and free from all possibility of chipping, cracking or falling. It provides a ready-built wall in convenient-to-use panels quickly installed without disturbance or delay. Houston Board has more lumber-like stiffness and rock-like hardness than has been attained in any previous wall and ceiling material.

Avoid Wall Troubles in New Building

When planning a new building, residential or commercial, the shortcomings of lath and plaster can be permanently avoided by building the walls and ceilings with Houston Wall Board. Cracked walls will always appear, sooner or later, with the lath and plaster job, but will never develop where Houston Board is used.

With Houston Board one is assured walls and ceilings that will never fall. They remain definitely repair free, warmer in winter but cooler in summer, vermin repellant, washable and sanitary.

Artistically—by painting, mottling and stenciling—an effect can be produced with Houston Board than is moderate in cost, yet expresses the finest principles of present-day interior decoration.

Houston Wall Board for Better Business

When business has a building or rebuilding need, it wants quick service. New business rooms require rapid completion, or if it is a matter of refinishing or rearranging present quarters, maximum speed combined with minimum disturbance are the chief essentials.

That's the great advantage of using Houston Wall Board. There are no delays. Put it up, paint at once, apply decorative trim, and the room is ready for use. If it is a partitioning or remodeling job, the room can be used while the work is in progress. Each panel is removable and replaceable—a great aid when changes or repairs are to be made to electrical circuits, gas or water pipes, or other plumbing.

Houston Board renews the usefulness of old buildings and secures freedom from wall troubles in new structures. Jar-proof, bright and sanitary, it is adaptable and appropriate in every kind of building—stores, office buildings, mills, factories, court houses, clubs, theatres, movies, lodge-rooms or churches. And it is the handy, dependable, display-making material for original effects in store-windows, cut-outs, booths and exhibits.

Wall Board Economy

In Remodeling Old Walls

EVERY home has waste space — in attic, cellar, porch or unfinished alcove — that would be contributing extra pleasure and good service to the house were it given walls and ceilings—an easy thing to do with Houston Wall Board. It will mean a house that is warmer in winter, yet cooler in summer.

In the attic there might just as well be a play-room for the children, or a billiard-room or den, a dance-room, a sewing-room, or a bed-room. A built-in laundry in the cellar, or a workroom, would likewise add to the comfort of the house. Built the convenient Houston way, these extra rooms can be had in a few days at little expense and small labor. The work is soon over without disturbing the rest of the household.

Age makes its first inroads in a building by cracked and crumbling walls and ceilings—defects that are usually emphasized by dingy wall paper. Rebuild—not repair—the walls and ceilings with Houston Board, and the old building becomes new again. The change is not a temporary expedient but a lasting restoration—you have new walls and ceilings which will last as long as the framework and foundation of the building itself.

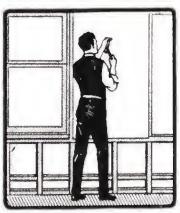
The economy of reestablishing serviceable and attractive walls and ceilings the Houston way is in the fact that the clean, readily handled Houston panels can be applied directly over the old wall and ceiling materials. None of the old material need necessarily be torn down. Just nail the board direct to the old materials and decorate as in new construction.

Wall Board Helpful in New or Old Work

Placing "Headers"

IN new construction, the carpenters who erect the framework and outside walls can finish the walls and ceilings if Houston Board is used. When the studdings and joists are in place, headers (2x2 or 2x4 or waste pieces of lumber) are inserted in accordance with the panel plan to provide a nailing surface for all panel edges.

Filling Holes



Nailing Panels

The panels are nailed directly to the studding, joists and headers and painted as soon as applied. Either oil or flat paint, or cold or hot water paint, may be used, one or two coats being sufficient. No priming coat is necessary as Houston Board is ready sized on both surfaces. The work is completed by placing decorative wood trim over the panel intersections. The use of fairly wide trim adds to the attractiveness of the result.

Nailing to Plaster

Painting Board

In repair and remodeling work, Houston Board is applied directly over the old walls and ceilings. The painting and application of decorative trim is exactly the same as in new construction.

Furring Brick

Over cracked plaster, large holes in the wall should be filled to make sure of a nailing surface for all panel edges. Over concrete, brick or stone, the walls are furred and the procedure is the same as in new construction. No preparation is necessary over wood, ship-lap or canvas.

Placing Trim

For complete information regarding uses and decoration possibilities of Houston Board, write for a copy of "Houston Rooms and How to Have Them."

Nailing to Wood

White Building Lime

For Strong White Mortar and Chemical Purposes

A WHITE LIME similar in quality and analysis to our Acme Lime, with the exception that it does not contain the two per cent. of oxide of iron and alumina, and thereby being white. A hot lime slacks immediately with the addition of water, guaranteed to be entirely free from core, and by reason of the high percentage of carbonate of lime, it will make a large amount of mortar. Not intended for skim coat in plastering, and not so suitable as our Pearl White for this purpose, although some of our customers use it in this manner. We ship direct from our works in barrels or bulk.

We stock New England Granular Lime.

Plastering Material Required for 100 Yards

Lath—for Hard Wall Plaster	1,600
Lath—for Lime Mortar, if very good lath	1,400
Lath—for Lime Mortar, if not good lath	1,400 to 1,600

Lath are generally spaced closer for hard plaster than for lime mortar.

Lime—for two Brown Coats	7 bushels
Nails	6 pounds
Hair	3 bushels
Hydrated Lime for Skim Coat	200 pounds
Plaster of Paris for Skim Coat	25 pounds
White Sand for Skim Coat	50 pounds
Neat Wall Plaster	700 to 800 pounds
Sanded Wall Plaster	2,000 to 2,500 pounds
Sand required for Neat Wall Plaster	25 bushels

On brick and stone work more sand should be put in Neat Plaster than for lath work—otherwise, mortar would be too rich.

Pearl Hydrated White Lime

A PREPARED LIME suitable for any purpose for which lime is used and especially adapted for finishing or skim coat in plastering.

Process and product patented in the United States, Germany, Great Britain and Canada.

A stable product which will keep indefinitely without danger of deterioration from air slacking or other chemical changes.

Prepared from the purest and best lime in Ohio by the only process that purifies the product and produces a perfect hydrated lime.

This product will cover more surface and work more smoothly than any other prepared lime on the market. We recommend that directions, plainly printed on each sack, be read.

Pearl Hydrated Lime makes the finest lime finish known to the trade.

Works smooth and cool under the trowel.

Does not chip, crack or blister on the walls.

More convenient than caustic lime and absolutely no waste.

Cheaper than lump lime—because it requires less labor and can be used immediately.

Put up in 50-pound paper bags. Each sack will cover twenty or more yards of skim coat.

The Metallurgical Laboratory

Analytical Chemists. Chemical and Mining Engineers

545 Liberty Ave. Geo. P. Maury, Manager.

Sample of Limestone Rock. Analysis No. 3165.

DETERMINED	Per Cent.
Silica	10
Oxide of Iron and Alumina	45
Calcium Carbonate	54 00
Magnesium Carbonate	45 27
Phosphorus	002
Lime from Above Stone	
Silica	19
Iron Oxide and Alumina	86
Lime	57 74
Magnesia	41 20

Pearl White Finishing Lime

(Hydrated Lime)

A PREPARATION of pure white lime, manufactured by a newly invented process, which will keep its strength indefinitely. It will not slack or swell with age, and when mixed with water will not give out any heat.

Pressed Brick Mortar

According to the richness of the mortar and the thickness of the joints, from 225 to 275 pounds "Pearl Finish" with sand or marble dust will lay 1000 brick, using one part "Pearl Finish" to about five parts sand by weight.

Plastering

From 650 to 750 pounds "Pearl Finish" with sand will cover 100 square yards including openings ¾-inch ground. Wet the "Pearl Finish" to a thin putty, work in the hair, one-third to two-fifths less than with lime putty, and stiffen with sand and dry "Pearl Finish."

For first coat use 1 part "Pearl Finish" to about 4 parts sand by weight.

For second coat use 1 part "Pearl Finish" to about 6 parts sand by weight.

White Coating

From 150 to 300 pounds "Pearl Finish" will cover 100 square yards, including openings, depending upon the character and quality of the second coat.

Mix up same as with lime putty, using from one-half to two-thirds the usual quantity of calcined plaster.

"Pearl Finish" makes a harder, whiter finish, and will positively not pit on the wall.

Where possible we would recommend mixing white coat a few hours in advance of using, otherwise it should be thoroughly tempered to insure complete assimilation with the water.

A short acquaintance with "Pearl Finish" is all that is required to handle the material with excellent results under any conditions.

Brown Coat

Is prepared quite differently in the various sections where this class of work is used. The above formulas give a general idea of its preparation with "Pearl Finish," subject to such variations as may suit the individual need.

Rough or Spread Mortar

150 pounds "Pearl Finish" with sand will lay 1,000 brick, using one part "Pearl Finish" to six or seven parts of sand by weight. The "Pearl Finish" should first be reduced to a putty, then add sand in the usual way, stiffening up with additional dry "Pearl Finish" if necessary.

Liming to Correct Acidity of the Soil

A DANGEROUS degree of acidity, or at least a fatal lack of carbonate of lime, appears to exist in upland and naturally well drained soils, and is not confined to muck and peat swamps and very wet lands, as most American and many other writers seem to assume.

That this condition of upland soils has not been more fully recognized heretofore is not surprising, for the reason that the future, or partial failure, of certain crops, has been attributed to winter-killing, poor germination of seeds, drought, excessive moisture, or attacks of insects or fungi.

Time of the Year to Apply Lime

The Fall is generally considered the best time to apply lime, although application may be made at most any time the farmer finds it convenient to perform the work.

Method of Applying Lime

In the first place it should be remembered that the tendency of lime is to work its way downward in the soil, so it should always be applied at the surface and never plowed under.

In the second place it should be remembered that the lime, when in its caustic or quick state, has the most power in producing chemical and physical changes in the soil. For this reason the aim should be to get the lime into the soil in its active state and have it thoroughly incorporated in the soil before it has had a chance to lose any of its active principles.

Method of Applying Ground Lime

While our customers mention to us the Empire Broadcaster, Bickford & Hoffman Grain Drill, Buckeye Grain Drill, the Spangler Drill and others, we believe the application can be made successfully with any good grain drill with proper phosphate distributor.

Amount Required

While generally speaking, this is a matter which must be determined on the ground, and by a person entirely familiar with the particular soil of the field, it is the custom of our patrons to use from 500 to 750 pounds per acre, depending upon the requirements of the case.

Land Plaster for Fertilizer

Gypsum is mined very much in the same manner as limestone, and is the basis of all patent or hard wall plasters. Calcined plaster or plaster of Paris is raw gypsum with the moisture driven off and ground to a great fineness.

Raw gypsum when ground as mined is known as land plaster and is one of the most useful fertilizing agents known. It possesses a remarkable affinity for ammonia, and is, therefore, a splendid vehicle for carrying that important chemical into the soil.

It also has the remarkable property of withdrawing moisture from the air and of retaining it long enough to be absorbed by the soil over which it is spread.

From these properties it is invaluable as an aid to fertilizing. Sprinkle your manure heaps with Land Plaster. It will retain the ammonia until you are ready to use it on your fields. When used in this manner the manure retains its vigor and is not devitalized before the waiting earth has a chance to absorb the needed chemical. When spread over the soil, however, the Land Plaster immediately releases its prisoner and the good work goes on. Spread Land Plaster over your parched soil in time of drought. It will gather moisture from the air current and pass it on to the soil.

Sprinkle Land Plaster about year manure heaps, in stables and cow barns. It will render them sweeter, and better the health of your stock.

Neat Wall Plaster

NEAT WALL PLASTER is practically the same as sanded wall plaster except that it does not contain the sand; you add the sand at the job. Packed in 100-pound cloth bags or 80-pound paper sacks.

Directions

For base-coat on wood or wire lath: Mix two parts of clean, sharp sand to one of plaster.

For brick or tile walls: Mix three parts of sand to one of plaster.

Use a clean and tight mortar box, about 3x7x1 foot, raised about three inches at one end.

Put in first a layer of sand, and then a layer of plaster, and when ready hoe dry from one end of the box to the other and back again, working together thoroughly in the operation. Leave material in raised end of box and pour water in lower end. Then hoe mortar gradually into water, allowing it to thoroughly absorb same, working to proper consistency.

Caution

When we refer to sand in these directions it must be understood that we do not mean beach or loamy sand, as a good wall cannot be had from such a mixture. Use only sharp sand free from gravel.

If you use a water pail for a measure of sand, mix seven pails of sand to each 100-pound bag of plaster for lath, or nine for brick or tile.

Estimates

In general we would say that eight bags of material, when mixed with the proper quantity and quality of sand, will brown 100 square yards on wood lath. Not controlling the work, however, we cannot, of course, be expected to guarantee these estimates.

Crooked walls and heavy grounds take more material, naturally, than straight work and regulation grounds.

Instructions for Applying

Grounds: Should be ¾ inch on Wood Lath; ½ inch for Brick or Tile; ⅜ inch over face on Wire Lath.

Lathing: Wood lath to be No. 1 white pine, spruce or yellow poplar, free from knots or bark.

Space lath ¼ inch apart and drive nails hard. If lath are dry they should be well sprinkled before mortar is applied, as this will prevent trouble from buckling. Half green lath are best. Apply as you would any mortar, bearing in mind, however, the following:

Do not mix up more material than you expect to use in from half to three-quarters of an hour. Clean box of one gauging before mixing a second.

Use clean water and keep tools clean.

In floating, use a damp brush only and do not drench the wall with water.

Do not float after the wall has set, as you will kill the face.

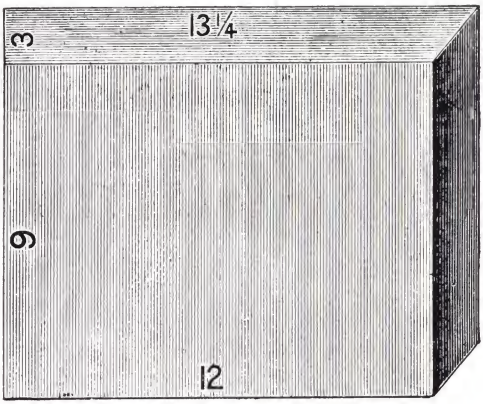
Keep temperature of house above freezing point in winter, and keep out hot blasts of wind in summer.

Should your work, after drying, show white, soft spots, this is evidence of improper mixing, or of too quick drying.

Wet the spots with clean water and brush until they set up.

Chemical action is what is lacking, and the water supplies the necessary vehicle for same.

Boiler Tile



SIZES:

—

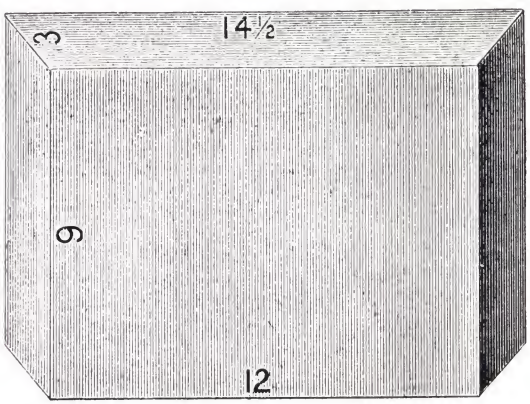
12-inch
14-inch
16-inch
18-inch
20-inch
22-inch
24-inch

12-Inch Side Boiler Tile

WE carry a stock of center, side and aft boiler tile in sizes commonly used in this vicinity.

Each center, side and aft boiler tile is made to cover a space of 9 inches in the direction the course is being laid, or in other words, every center, side or aft boiler tile is 9 inches wide.

The length of the side and center boiler tile is the length of the shortest side, viz.: On the accompanying cuts the side boiler tile shown is a 12-inch side boiler tile, and the center boiler tile shown is a 12-inch center boiler tile. The other measurements thereon are to enable you to make proper calculations as to the width and thickness and the difference in length on the long side.



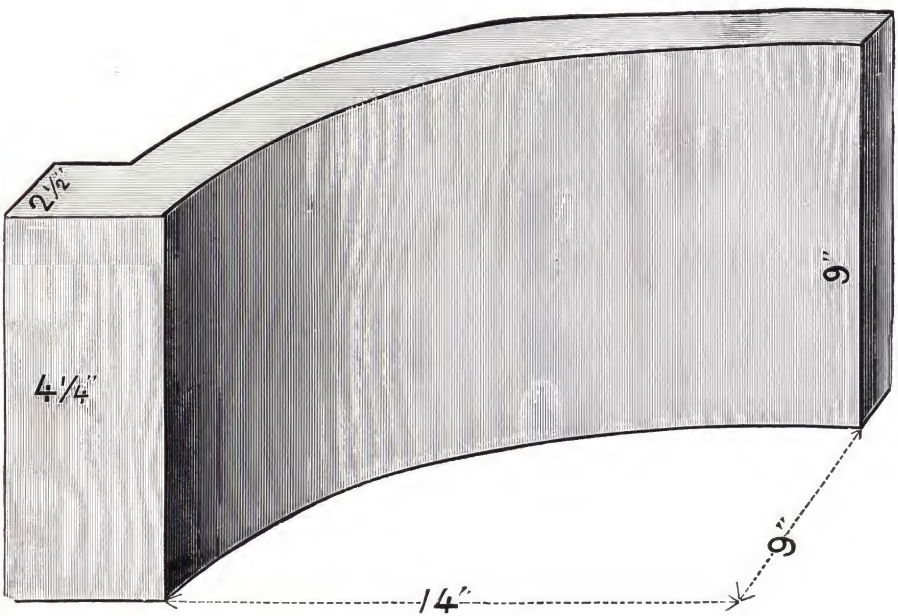
SIZES:

—

12-inch
14-inch
16-inch
18-inch
20-inch
22-inch
24-inch

12-Inch Center Boiler Tile

The size of the aft boiler tile is designated by the distance horizontally on the wall on which they rest to the end of the boiler against which they are placed, as shown by the base dotted line between the two arrow heads on the last cut, viz.: The aft boiler tile on the following cut is a 14-inch aft boiler tile and should be so designated when ordered. The aft boiler tile are laid at the rear of the boiler on top of the brick work and the side boiler tile on the sides. Center tile are only used for double boilers and are placed in between the two boilers.



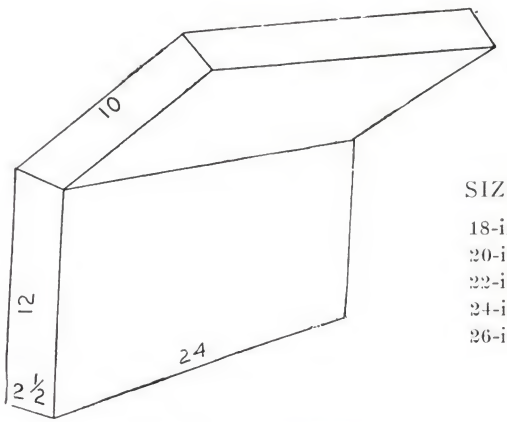
14-Inch Aft Boiler Tile

SIZES: 12-inch. 14-inch. 16-inch. 18-inch. 20-inch. 22-inch. 24-inch.

The thickness and width of the respective kinds are the same on all lengths of center, side and aft boiler tile; therefore, in placing orders, kindly mention but the one size in length, as specified on the cuts.

Grate Tile

MANUFACTURED of the best grade of Bolivar fire clay. All sizes carried in stock and prompt shipment can be made.



SIZES:
18-inch
20-inch
22-inch
24-inch
26-inch

This is a 24-inch grate tile for use with a 22-inch grate and front.

General Information About Brick

All shapes in the 9-inch series are rated as 9-inch, and are sold by count, each the same as one full sized 9-inch brick.

A 9-inch brick (straight) weighs 7 pounds and contains 100 cubic inches. Six 9-inch bricks will make one square foot of face wall. Fifty-four 9-inch bricks will make one square yard of face wall. Seven and one-half 8½-inch mill or building bricks will make one square foot of face wall. Sixty-eight 8½-inch mill or building bricks will make one square yard of face wall. Thirty-nine 8½-inch mill or building bricks, laid flat, will pave one square yard.

To secure the best results, fire brick should be laid in the same clay from which they are manufactured.

One ton of ground clay should be sufficient to lay 3,000 ordinary brick.

Brick Work

Walls are estimated to contain seven bricks for each superficial foot one-half brick thick.

			Per sup. ft.
A 4-inch wall, or	½ brick	thick, contains	7 bricks.
A 9-inch wall, or	1 brick	thick, contains	14 bricks.
A 14-inch wall, or	1½ bricks	thick, contains	21 bricks.
A 18-inch wall, or	2 bricks	thick, contains	28 bricks.
A 22-inch wall, or	2½ bricks	thick, contains	35 bricks.

Fire Brick

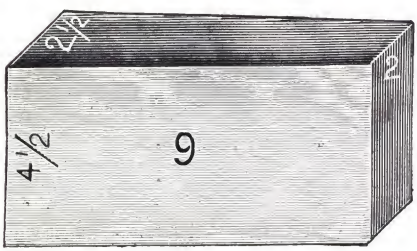
SAVAGE is one of the highest grades of fire brick on the market. Should be used wherever great heat is required, such as melting iron, steel, etc. We carry a large stock on hand at all times.

9-Inch Fire Clay Brick

Fire Brick Shapes. 9-inch

We generally carry the following shapes, both in the high grade and common grades at all times. Can ship local lots from Pittsburgh warehouse stock.

No. 1 Split



No. 1 Wedge

5 Feet Diameter Inside. 98 Brick to Circle

Fire Brick

Fire Brick Shapes. 9-inch

No. 2 Wedge

2 Feet 6 Inches Diameter Inside. 4 Feet Diameter Outside. 60 Brick to Circle

No. 1 Arch

3 Feet Diameter Inside. 57 Brick to Circle.

No. 2 Arch

2 Feet Diameter Inside. 42 Brick to Circle.

Fire Clay

SUITABLE for brick and furnace work carried in stock at all times. Can make shipments in sacks or barrels, or carloads in bulk. We recommend the rolled or flake clay as the most desirable.

One barrel of fire clay to 500 fire brick is about the proportion. Fire clay should be used as a thin paste and not as a mortar. The thinner the joint the better. A 9-inch fire brick (straight) weighs seven pounds and contains 100 cubic inches. Six 9-inch brick will make one square foot of face wall.

Hollow Tile

PERHAPS no building material so successfully combines the qualifications necessary to structural permanency and beauty as does Hollow Tile.

Hollow Tile is safe—it is strong—it is easy to use—it is free from depreciation—it is a great resistant to extremes of temperature—it is permanently dry and sanitary—it is in short the ideal building material for architect and contractor, giving a maximum degree of satisfaction and the assurance of meeting every possible requirement of builder or owner.

Advantages of Hollow Tile

STRENGTH. The strength of any wall is chiefly dependent upon two factors: first, the material or units of which it is built, and second, the method of joining or building material or unit in place.

In Hollow Tile construction the first item is the tile, and in these units we have a material which has an ample surplus of strength, for all ordinary requirements, greater than any cementing bond of mortar that may be used in its erection. The strength of any wall built of this material is therefore, as with more forms of wall construction, dependent on the second factor or cementing medium.

With all forms of Hollow Building Tile construction only a cement mortar should be used, and the amount of mortar required is comparatively so small that there is little reason for using anything other than a good rich mixture.

Depreciation. Closely connected with the question of strength is the question of depreciation of the material itself. The cementing medium must also be considered.

In Hollow Tile construction there is absolutely no depreciation of the material itself. Hard burned clay has stood through all the ages and will continue to do so as long as man exists on earth. The cementing medium is almost equally as permanent. This material was used by the Romans and is responsible for the wonderful permanence of their great masonry structures. There is a further feature to consider:

In most forms of Hollow Tile wall construction the cement joints between the tile are covered and protected from the ravages of the elements by the stucco finish or veneer of brick or stone.

Insulating Value. Heat or cold may penetrate the walls of a building in two ways: first by conduction through the solid material of which the wall is built, as all materials are more or less conductors of heat and cold, and second, by leakage, either through the wall construction or around window and door frames.

There can be no appreciable leakage through any dense masonry material, and the hard burned clay of which Hollow Tile is made is an effective bar to any such leakage. Conduction is the only way by which heat or cold may be transferred through a wall of Hollow Tile. Air, particularly dead air, is the poorest conductor of heat, and for this reason it is utilized for the purpose of insulation in Hollow Tile construction. Air cells are built into the wall in such a manner that any conduction of cold through the solid material is absorbed and neutralized within the wall itself. In winter the interior of the wall becomes warmed by the interior temperature of the building and when thus warmed will set up air currents within the tile cells that will oppose and neutralize the transmission of cold induced by the outside cold.

A properly constructed tile wall has never been known to fail as an effective resistant to the transmission of heat and cold.

Dryness. There are two ways by which the inside surface of any wall may become damp or wet; first, by absorption of moisture from the outside, either from rain, snow and damp outside air or by capillary attraction from the moist ground in contact with the lower portion of wall, and second, by the condensation of moisture from the interior atmosphere, generally referred to as "sweating."

Condensation or sweating is a condition that is common to all walls under certain conditions and may occur with any form of wall construction however perfect the insulation that particular construction may afford. Where the interior air becomes over-saturated or laden with steam from cooking and laundry work, the only cure

Advantages of Hollow Tile

is ventilation, or the circulation of dry air. Condensation will naturally occur to a much greater extent with walls that have a low insulation value, and the wall of Hollow Tile is therefore less liable to this condition than most other forms of construction.

The first cause of damp walls, that of absorption, does not require consideration in-so-far as the Hollow Tile is concerned, as this product is burned to a density that renders the absorption too low to cause trouble even under the most severe weather conditions. Hollow Tile is essentially a dry wall and therefore promotes health. Damp walls are very unsanitary, and apart from their general bad effects on the health of inmates, germs and bacteria will prosper and multiply, particularly in warm weather, under such conditions.

In the Hollow Tile wall the conductive mass is greatly reduced and the absorption of heat or cold is dissipated into the warmed dead air contained within the cells of the tile before it has an opportunity to affect the interior surface. Similarly the interior temperature is unable to escape as the same process prevails and the two opposing forces meet and are neutralized somewhere within the wall. Therefore the interior face of a Hollow Tile wall is never really cold or hot and except under extreme conditions approximates the interior temperature of the room.

Apart from foundation and cellar walls or other walls in contact with the earth, there is little danger of any moisture permeating a Hollow Tile wall, and in order that the tile for foundation may be safeguarded against a defective mortar joint that would permit ground water to enter the cells of the tile, it is customary to cover the exterior face with a coat of dense cement mortar or brush the face of the tile with an asphalt or tar damp-proofing compound.

Hollow Building Tile properly laid will make a bone dry cellar and there is no better material for residence foundations.

Fire-Resistive Walls. To be fire resistive, a wall must first be built of incombustible material; second, it must withstand heat without cracking, disintegrating, or losing its strength. In the manufacture of Hollow Tile, man is simply duplicating the earth's process of rock making on a small basis. A wall built of hard burned clay cannot be burned or destroyed by fire. Furthermore, being a non-conductive wall, it will protect inflammable material on the opposite side from ignition or damage. It is a dependable fire wall material. Where the Hollow Tile is confined and anchored to some structural member there may be a good reason for using a porous tile that will internally absorb any expansion from heat, but for wall purposes there is greater opportunity for expansion, and the stronger dense tile is the recognized standard wall material.

Permanence. There is no maintenance expense connected with Hollow Tile wall. It is built to stay for all time and when the last tile has been laid completing the wall, there is no expense whatever in the way of maintenance and repairs.

Comparison of Tile Sizes With Brick

Allowing for the joints in brick work, the several sizes of standard hollow tile are equivalent to the following number of brick, based on the standard size common brick as adopted in February, 1920, which is 8″ x 2¼″ x 3¾″. ⅜″ thick joints are allowed for in connection with brick.

4 x 12 x 12 tile equals	7 bricks
8 x 12 x 12 tile or wall equals	14 bricks
12 x 12 x 12 tile or wall equals	21 bricks
4 x 5 x 12 tile equals	3 bricks
8 x 5 x 12 tile equals	6 bricks

Characteristics and Uses of Hollow Tile

HOLLOW Building Tile is an incombustible product of burned clay or shale of high structural value, which may be divided into five grades of ware, each of which is more or less particularly adapted to certain requirements, and all of which may be used for certain other purposes.

The five grades are as follows:

(1) Very Hard Burned or Vitreous. All Hollow Tile which have less than 8 per cent absorption may be placed under this heading which calls for a very hard dense product, specially suitable for the construction of foundations or other work in contact with the earth or for exterior walls without stucco or other covering, where the exposure to weather and resistance to moisture are of prime consideration.

(2) Standard Hard Burned. This calls for a Hollow Tile having not over 12 per cent absorption which is the standard specification for lead bearing tile for exterior walls and other similar work where the walls are to be stuccoed or veneered with brick, stone or other covering.

(3) Ordinary or Medium Burned. Under this classification falls the major portion of all Hollow Tile manufactured for fireproofing and interior construction, and it is best described as a tile having an absorption value greater than 12 per cent, but otherwise reasonably hard burned, dense or semi-porous in structure and having a perceptible ring when struck. Generally this is the grade of ware preferred by mason contractors and by plasterers for all interior work, because of the suction which helps make the mortar or plastering adhere and "hand" and, consequently, saving in labor for erection. This grade of ware for this very reason is not generally suitable for exterior wall work, unless waterproofed stucco is used and it further often does not develop the crushing strength that is required of Hollow Tile for load bearing walls.

(4) Soft Tile. Two kinds of tile fall under this heading: first, the ordinary underburned dense tile, which is the first cousin to salmon brick and about which no more need be said, although it has its special sphere of usefulness and is still used to a great extent for interior work in some sections of the country. Second, full porous tile which is made by the addition of sawdust or other combustible matter to the raw clay, producing a tile that can be nailed into. Porous tile although generally made with quite thick shells, is somewhat lighter in weight than the standard or ordinary ware, and has a comparatively low crushing strength, but is specially adapted for book tile, roof and ceiling blocks, nailing blocks and other special purposes for which this grade of ware is used.

(5) Salt-Glazed Tile. This classification or grade refers to a dense tile of fire clay or shale that is glazed in burning like a sewer pipe or conduit and it is therefore specially adaptable to resist the action of moisture and frost and for that reason is extensively used for foundation purposes.

Frequently the term vitrified is used to apply to salt-glazed ware, although a clay can hardly be glazed without being vitrified; therefore to avoid confusion, it is best to use the term vitrified as applying to a very hard burned unglazed tile.

Characteristics and Uses of Hollow Tile

Strength of Structural Tile. Hollow Building Tile in all but the softer grades of ware develops a crushing strength that enables it to be used for the construction of load-bearing walls, and when built in the wall it will support a load approximately from five to twenty times the weight of the wall itself, with an ample factor of safety for all walls of normal heights. The limiting factor in the support of load or resistance to stress in all of the hard burned grades of tile is usually the mortar joints, as the tile develops a crushing strength greatly in excess of the strength of average good Portland cement mortar. For this reason, in load-bearing walls only a fairly rich Portland cement mortar should be used, and even for interior fireproofing purposes a cement mortar should be used on account of its greater fire-resistive qualities.

Fire Resistance. Hollow Tile, being the product of the hottest of fires, has a very high resistance to the action of fire and has withstood the extreme test of many conflagrations. When used properly, Hollow Tile fulfills the most exacting requirements of fire protection. An excellent bond is obtained between cement mortar or concrete applied to or deposited on Hollow Tile, and therefore Hollow Tile may be combined with these very useful structural elements in many various ways.

Weight of Hollow Tile Walls. The density of all the hard grades of Hollow Tile is such that the absorption factor is very low and it therefore effectively resists the action of moisture and frost, both above and below grade, and it is not affected by acids.

A cubic foot of Hollow Tile weighs from 40 to 50 lbs., while the same quantity of cinder concrete suitable for structural purposes weighs about 100 lbs., and stone gravel concrete from 140 to 150 lbs., and a cubic foot of brick work will average not less than 120 lbs.

Ease of Inspection. Hollow Tile is not deceptive, it is not the result of a mixture of compounding of different elements; burned clay and only burned clay constitutes its structure, and when the burning is right, satisfactory tile is assured. If not properly burned, this fact is evident from a most casual inspection. This ease of inspection and assurance as to quality is a valuable factor to the architect or engineer, as all questions regarding workmanship in manufacture are eliminated.

Varied Use. Hollow Tile construction was originally developed to make possible the erection of all skeleton frame structures, in connection with which it effectively protects the structural steel frame from corrosion and fire, at the same time forming the structural element for floors and partitions which encase the frame and divide the space enclosed by same into floors and rooms, etc.

At the present time one of the greatest developments is for the construction of low cost walls for residence, apartment houses, farm buildings, school houses, factories, garages, etc., in which field it most effectively fulfills the demand for easily erected, enduring masonry construction, at minimum initial and maintenance cost. The insulation value of the hollow, moisture-proof, vermin-proof, sound-proof walls, that are so easily erected from the units provided, make it particularly well suited to these types of structure.

Hollow Tile for Load-Bearing Walls

THE strength and resultant carrying capacity, the comparative lightness in weight and consequent saving in structural material and the economy and ease of erection, combined with permanence and resistance to fire and weather, have naturally fostered a very large and constantly growing use of Hollow Building Tile for load-bearing walls, in residence buildings, including flats and small apartments, churches, schools and skeleton frame buildings, for both residence and commercial purposes. In the former, it may replace the more extensive forms of solid masonry, either used with stucco finish or as a backing for brick or stone work, but it is more often used in place of frame wall construction on account of its permanence, freedom from shrinkage and cracking, and other advantages.

In the skeleton structures, while sometimes finished with stucco, it is generally used as a backing for face brick of cut stone, and for this purpose it combines with other advantages that of greatly reducing the weight of wall to be carried on the skeleton frame and consequent saving in structural steel or reinforced concrete frame and the supporting foundation.

In connection with load-bearing Hollow Tile walls for small to moderate sized residences, garages, stores and similar buildings, Hollow Tile foundation walls have ample strength and are in every way satisfactory. This type of foundation wall gives a drier basement for cellar than the average solid masonry wall of similar thickness.

The shape shown in Fig. 950, cut in 12″ lengths, may also be used as a corner block for walls of 8″x12″x12″ end construction units, where the wall is built of smooth or glazed tile that is to be left exposed.

The shapes shown by Figs. 948, 948A, 949 and 949A are given for exterior dimensions only, as the interior arrangement of cells and cross webs may vary to suit the varied product of the different manufacturers, many of whom feature special forms of load-bearing tile, some of which are patented, and for all of which certain particular advantages are claimed.

End construction walls do not require closure tile at plain jambs and wall ends as a full tile forms the full closure and a half or cut tile or corner tile is used for the half closure. Similarly, as the side construction wall does not require the horizontal closing of cells under window sills, roof plate, etc., the vertical cells in an end construction tile should be capped off under all openings, at all joist bearings, and on top of wall under roof plate, cornice or coping. Even where a terra-cotta or stone coping is used, the top of the wall should first be capped off so as to close the cells and give a proper setting bed for coping.

For these purposes a slab or plate of tile is used which is furnished in the various widths required: 4″, 6″, 8″, 10″ and 12″ in 12″ lengths. These slabs are about 1″ in thickness and may be supplied singly, in pairs, or in nests of 4 to 8, according to the method of manufacturing same.

Fig. 906 is only shown as an example of the still tile for the various thicknesses of load-bearing walls.

Special sill and window jamb shapes for metal frames and for other purposes are also manufactured to order and are carried in stock.

With the range of shapes now obtainable it is practicable to build the entire walls of most residence, factory or other structures without the use of any special shapes.

Standard Shapes of Tile for Side Construction

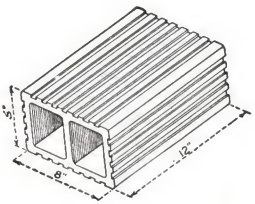


Fig. 877—8x5x12 unit for Side Construction.

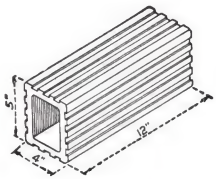


Fig. 877-A—4x5x12 unit for Side Construction.

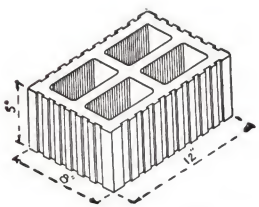


Fig. 948—Closure Tile for Side Construction.

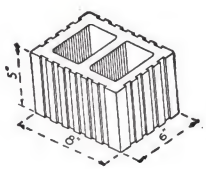


Fig. 948-A — Half-Closure Tile for Side Construction.

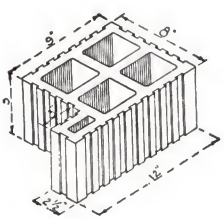


Fig. 949—Jamb-Tile for Side Construction.

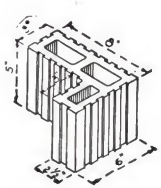


Fig. 949-A—Half-Jamb Tile for Side Construction.

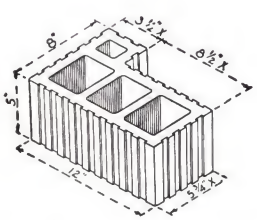


Fig. 950 — Special Corner Tile for Side Construction.

Hollow Tile for Load-Bearing Walls

In the agricultural localities hard burned ordinary 5″x8″x12″ building tile is more extensively used than any other shape, and in fact few other shapes are used. If the farmer wants to build a garage or a chicken house, he builds a 5″ wall with the tile on edge; if a barn, a residence or a dairy building, he lays it flat, building an 8″ wall.

When arches occur in walls, they can very easily be turned with the Hollow Tile blocks or with hollow brick. Due consideration to the proper abutment of such arches should be given. It is not advisable to build arches too close to the corners of walls or to have them supported on slender piers.

The plates showing details are drawn for walls 8″ thick above first-story joist, as this is the typical and recognized standard construction for all ordinary residence building.

An 8″ thick Hollow Tile foundation wall is ample for all moderate sized residence buildings, where the length is not too great between corners or cross walls, or bracing piers, such as are formed by chimney foundations, or other thickening up of wall.

Face brick and Hollow Tile have been successfully used together for a long time. The combination of Hollow Tile and sawed stone ashlar has great possibilities that have not yet been fully developed, but which are sure to be quite a factor for certain classes of buildings in the future. Many people prefer cut stone to stucco or face brick and are willing to pay the extra cost for a surface of limestone.

The regular light weight "backing-up tile" is designed for the backing-up of face brick or for enclosing or curtain walls of skeleton structures. When Hollow Tile is used for primary or load-bearing walls, the load-bearing 8″x5″x12″, 4″x5″x12″ or other form of load-bearing tile should be used. A number of special forms of load-bearing tile for backing-up purposes are made by the various manufacturers, also some feature the end construction tile for this purpose and furnish specially designed bonding blocks.

In all cases, in load-bearing walls, where face brick or cut stone and Hollow Tile are used in combination, a masonry bond between the two materials should be used so that the full thickness of the two materials can be counted as the thickness for load-bearing purposes to comply with code requirements, as otherwise the carrying capacity of the facing material is seldom considered. Very few city building codes will permit the facing material to be figured as a part of wall, where only metal ties or anchors are used.

Standard Shapes of Tile for End Construction

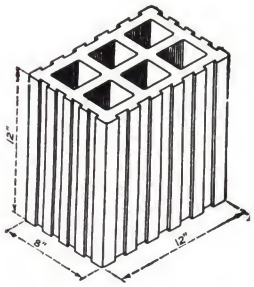


Fig. 880—8x12x12 unit for End Construction.

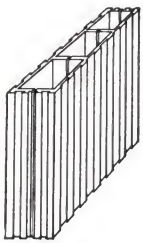


Fig. 884-A—2x12x12 unit for End Construction.

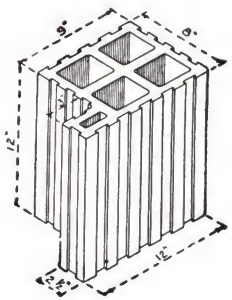


Fig. 938—Jamb Tile for End Construction.

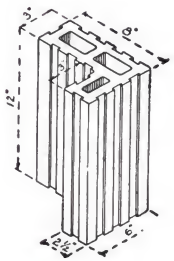


Fig. 939—Half-Jamb Tile for End Construction.

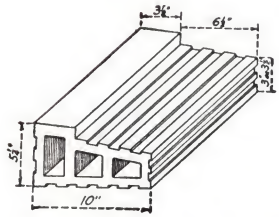


Fig. 906—Sill Tile for both End and Side Construction.

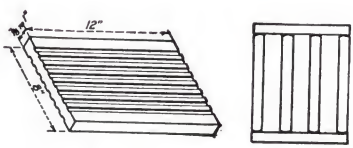


Fig. 928—1x12x12 Slabs for End Construction. Showing form in which Slabs are usually made. A tap on the corner separates the tile into slabs.

Bonding of Walls

THE placing of openings for doors and windows in Hollow Tile walls and the details for bonding of walls at corners and around openings is naturally divided as follows:

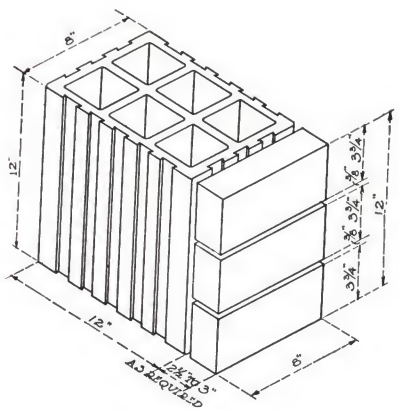
First—Walls that are to be stuccoed or otherwise veneered and for which the breaking of joints between courses is required only for strength.

Second—Walls built entirely of Hollow Tile and for which the bond is required both for strength and appearance.

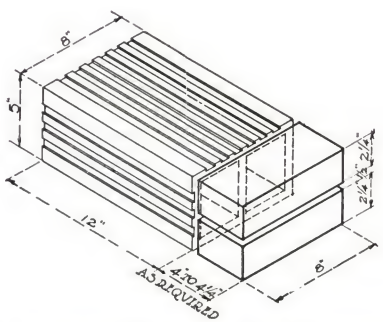
Generally a smooth or texture face tile is used for farm buildings, placing such buildings under the second classification. The ordinary rough structural tile is generally used for homes finished with stucco or brick.

There is no valid objection to the use of an ordinary scored building tile product for any rough or unfinished structure, providing the tile is of the hard burned variety having a low absorption value and preferably has little or very shallow scoring on the faces.

Any bonding that gives suitable strength to the wall will meet the requirements of the first instance, while only a bond which combines with this in an even working out of the courses between openings, conforming to and aligning with the running bond throughout the balance of the walls will generally be considered satisfactory for exposed tile walls. For this latter reason a 6″ running bond is usually preferred, having the joints between the tile in one course occur midway over a tile in the course below.



Showing use of common brick with 8x12x 12 tile. Brick may be used in a similar manner to close up ends of cells when this shaped tile is laid up in side construction.



Showing use of common brick for closing ends of cells in 8x5x12 tile.

Bonding of Walls

It will be noted from the accompanying details that the 6″ bond has a decided advantage, as it simplifies the working up to and bonding around openings. In any wall in which a finished jamb or reveal is required at openings, it is customary to use two shapes or sizes of tile, one the full 12″ length and the other a short or half-length to accommodate the running bond of wall courses. These are referred to as "full closures" and "half closures" where the end face gives a straight reveal, or "full jambs" and "half jambs" when the end face is rabbitted to form a recessed reveal, to provide for box window frames.

Naturally these shapes must be made to some standard length, and as the full jambs and closures are made to conform with the standard length of the regular building tile, the short jambs and closures are accordingly made to half the length less ¼″ to allow for thickness of vertical mortar joint. These sizes therefore call for a 6″ running bond.

The advantage of this bond is explained by the diagram, Fig. 117, which shows the placing of an opening on walls that have the vertical joints between tile in alternate courses evenly staggered, giving a 6″ running bond. It will be noted that only two shapes are required to work up to opening, the full and half-length tile, also that the sill and lintel will have an even projection and bearing each side of opening.

It is very seldom that the layout of openings and courses in any ordinary building cannot be arranged to conform to the even arrangement shown by Fig. 117, by adopting sizes for the door and window frames that will conform to multiples of full or full and half-length tile with allowance for joints as already referred to. This gives steps of 6¼″ in width of openings. Details for the various corner bonds for 4″, 5″ and 6″ walls are given on the following pages.

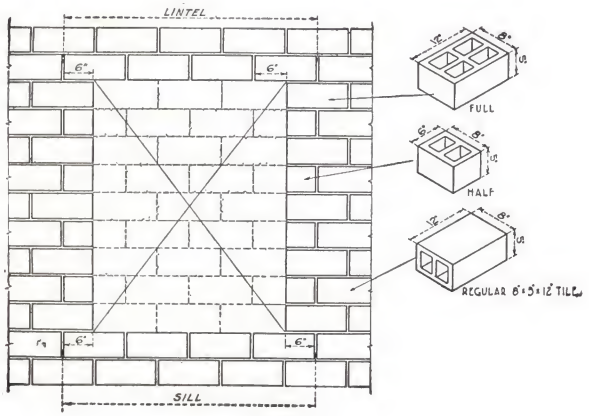


Fig. 117

Method of allowing for closures and half-closures in connection with window and door openings to secure proper bonding in the wall.

Hollow Tile for Partitions and Floors

IT has been proven beyond a doubt that hollow tile partitions will withstand a great conflagration. Where they were properly built upon the fireproof arches or steel beams, laid with cement mortar and wedged against the floor arches at the ceiling above, they stood intact, while all forms of plaster blocks crumbled into rows of rubbish and metal lath partitions twisted into scrap iron.

In addition to the fire-resisting qualities of hollow tile partitions, they are light, strong, easily erected by bricklayers, and do not transmit heat, cold or sound.

About 15 per cent of the quantity of tile required should be of full porous material for nailing the wood trim. In schoolhouses, where blackboards have to be fastened on the walls, all of the tile should be full porous. These are slightly more expensive, but make a better partition for any purpose. All partitions and furring tile, unless otherwise specified, are scratched to receive plastering. If the surface is to be whitewashed the tile are made smooth.

Wood or channel-iron bucks are placed in all doorway openings. These should be 1½ inches wider than the thickness of the tile and act as grounds for the plastering.

It is not generally practicable to use 2-inch tile for partitions, except for closets, shafts, etc., unless they are reinforced by metal. Where room must be economized we suggest the use of 2-inch partition tile with the truss wire in the horizontal joints. This is inexpensive and effective.

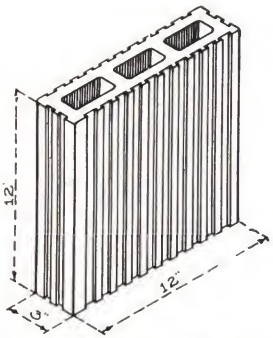
Three-inch partition can be safely used up to 12 feet in height, 4-inch to 16 feet, and 6-inch to 20 feet.

The tile are commonly made 12 inches high by 12 inches long, although some prefer to have them 8 inches high. They can be made any size required, but special sizes are necessarily more expensive.

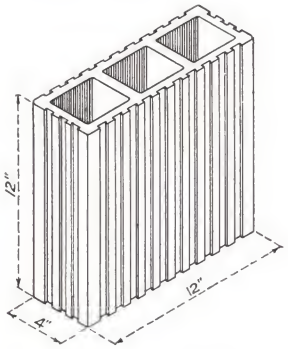
In office or apartment buildings it is good practice to have all the main corridor and stairway and elevator enclosures of 4-inch, and the partitions between rooms 3-inch. Partitions should be bonded where meeting and anchored to wood bucks or brick walls by using tenpenny nails, at least, in each second joint.

Tile should be set on end, except top course, which may be set on side. When required for outside walls exposed to the weather the tile must be specially made of dense material, hard burned. They may be made smooth on outside face and do not require plastering. If, however, a better architectural effect is desired, they are deeply grooved and given a coat of Portland cement stucco finish. They should be not less than 6 inches thick unless reinforced.

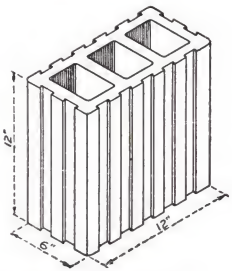
Partition Tile



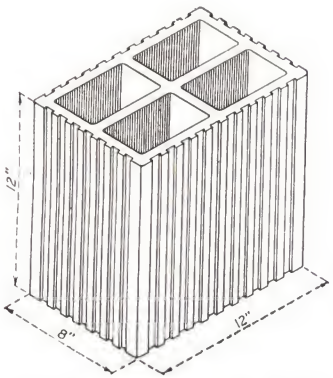
3x12x12—Weight 16 lbs.



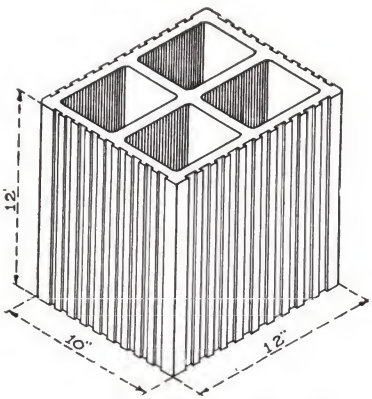
4x12x12—Weight 18 lbs.



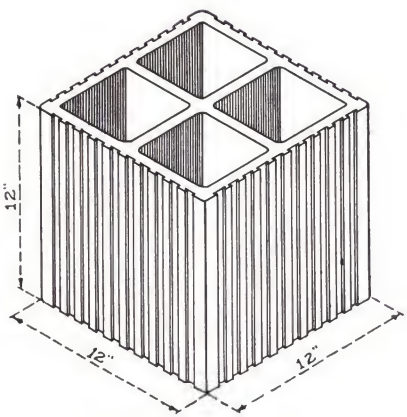
6x12x12—Weight 24 lbs.



8x12x12 (4 cell)—Weight 32 lbs.



10x12x12—Weight 38 lbs.



12x12x12—Weight 42 lbs.

Height for Non-Bearing Partitions

THE maximum allowable height for non-bearing partitions, non-bearing enclosing or panel walls, supported firmly and solidly upon a full bed at the bottom and held firmly at the top, should be as follows:

Size Tile	3″	4″	6″	8″	10″	12″
Maximum Height for Partitions	12′-0″	16′-0″	20′-0″	26′-0″	30′-0″	36′-0″
Maximum Height for Enclosing Walls	.....	.....	.....	24′-0″	30′-0″	36′-0″

Permissible Increase in Height

Non-bearing partitions, and enclosing division or panel walls, when built between rigid cross walls, piers, buttresses, pilasters or columns, and properly tied or bonded thereto, may have the heights given in the above table increased as follows:

Ratio of Length to Height of Wall	Increased Height Permitted
Length 1½ times given height	¼ of given height
Length 1 times given height	½ of given height
Length ½ times given height	¾ of given height

The thicknesses given in the table are exclusive of terra cotta, stucco or other similar ornamental facing. Solid masonry facing may be included in the thickness provided it is bonded with full masonry headers in courses not farther apart than 25″ vertically.

Toilet Room Floor Construction showing 4-inch Partition Tile cut in 6, 8 or 10-inch lengths, supporting ordinary partition or Book Tile on which the marble, tile, terrazzo or cement floor finish is applied on a bed of cement mortar.

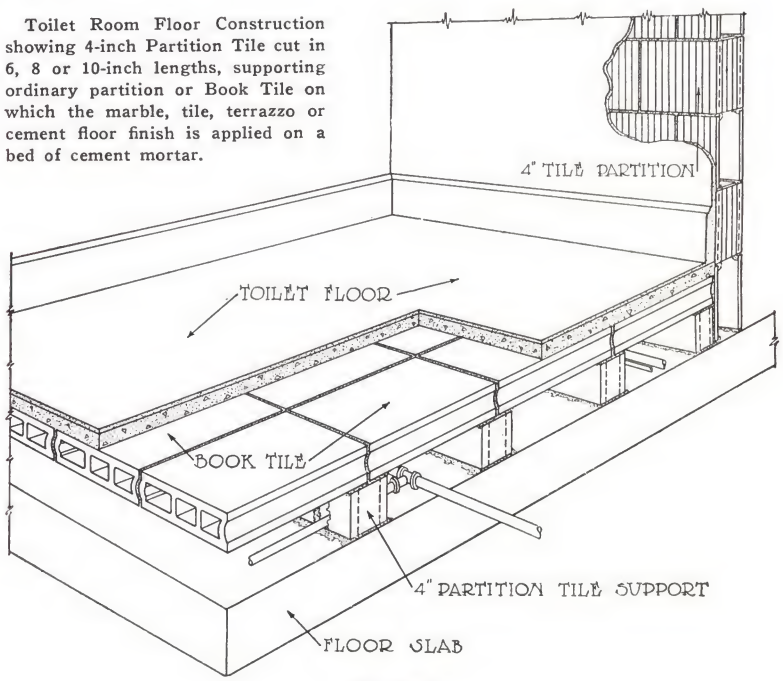
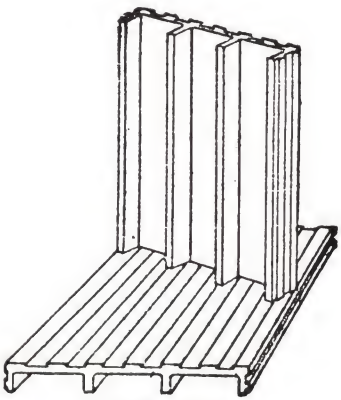


Fig. 1025

Wall Furring



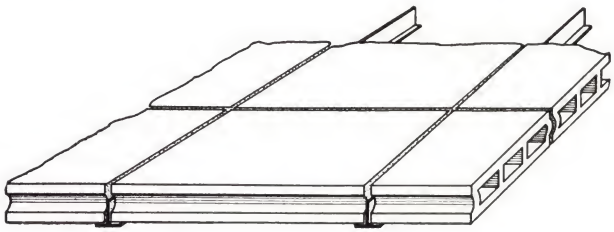
STOCK SIZES

1½ x 12 x 12 inches, weight per sq. ft., 10 pounds
2 x 12 x 12 inches, weight per sq. ft., 10 pounds

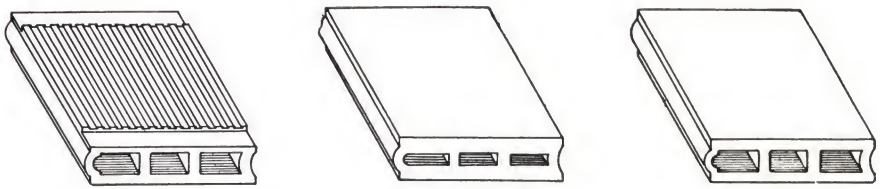
MOST solid masonry walls must be furred to prevent dampness from reaching the interior by capillary attraction and destroying the plastering or interior finish of the building. Furring is usually advisable as it greatly increases the insulating value of any wall whether built of brick, tile, stone, concrete, or other material. Furring is not needed with walls of Hollow Tile. This may seem peculiar to some but the fact remains that such walls have proved dry and entirely satisfactory, which is doubtless accounted for by several factors; the great density of the tile, the smaller quantity of solid material and mortar in wall, the higher grade mortar generally used and the dead air spaces contained within the tile. Furring, however, will increase the insulation efficiency of a tile wall on the same principle that by an increase in the thickness of wall and number of cells the insulating value is increased.

Integral furring has particular merit for special purposes and should be used where building codes are so written that only the inner 4″ of a bearing wall may be of hollow brick or tile where the ordinary backing-up construction would not be permitted; in which case a saving of several inches in thickness and cost over the furred solid masonry wall will be effected.

Roof and Ceiling Tile—(Book Tile)



Standard Sections



Standard Sizes and Weights

Roof Tile, Inches

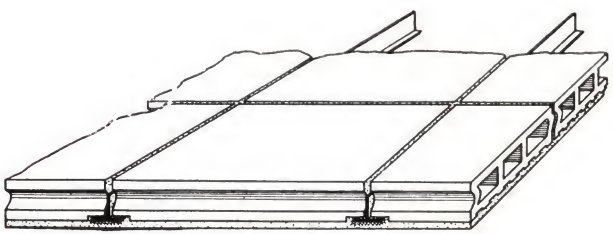
3 x 12 x 18.....20 lbs. per sq. ft.
3 x 12 x 20.....20 lbs. per sq. ft.
3 x 12 x 24.....20 lbs. per sq. ft.
4 x 12 x 24.....24 lbs. per sq. ft.

Ceiling Tile, Inches

3 x 12 x 16.....20 lbs. per sq. ft.
3 x 12 x 18.....20 lbs. per sq. ft.
3 x 12 x 20.....20 lbs. per sq. ft.
3 x 12 x 24.....20 lbs. per sq. ft.

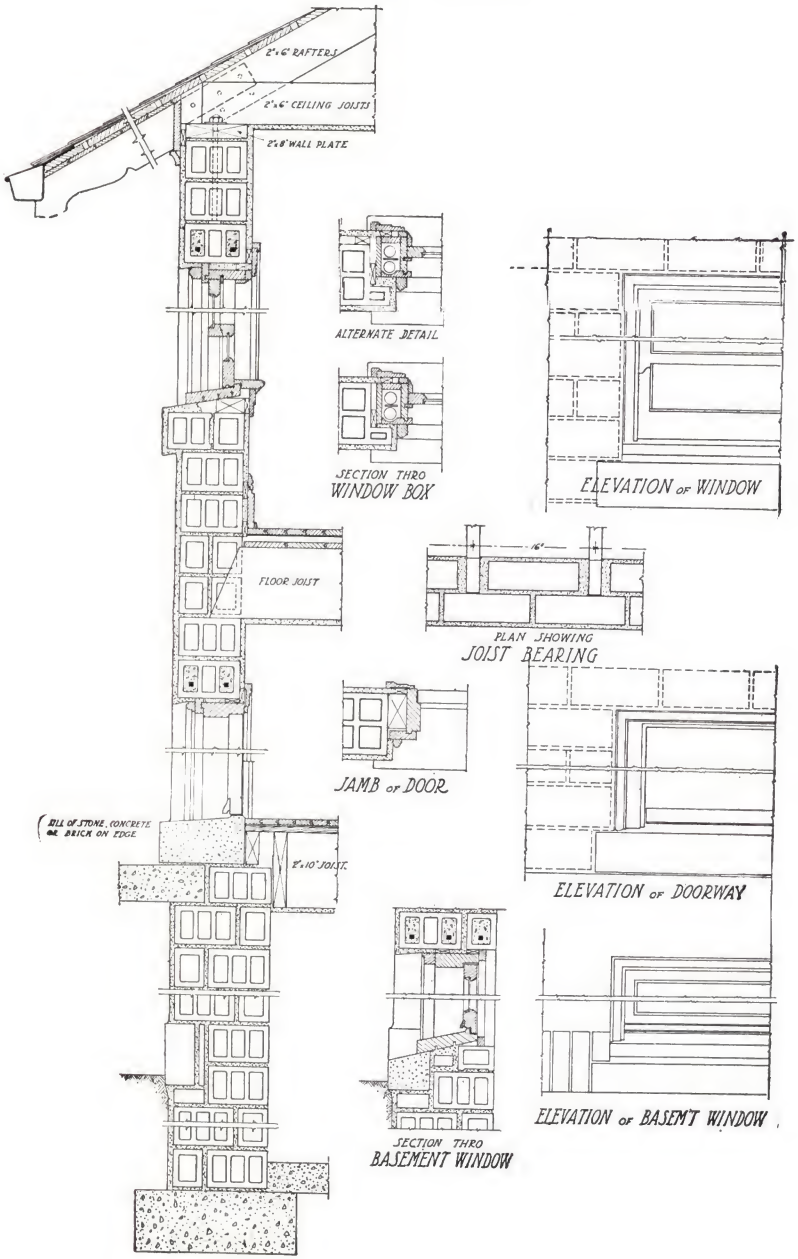
Ceiling Tile, Inches

2 x 12 x 16.....12 lbs. per sq. ft.
2 x 12 x 18.....12 lbs. per sq. ft.
2 x 12 x 20.....12 lbs. per sq. ft.



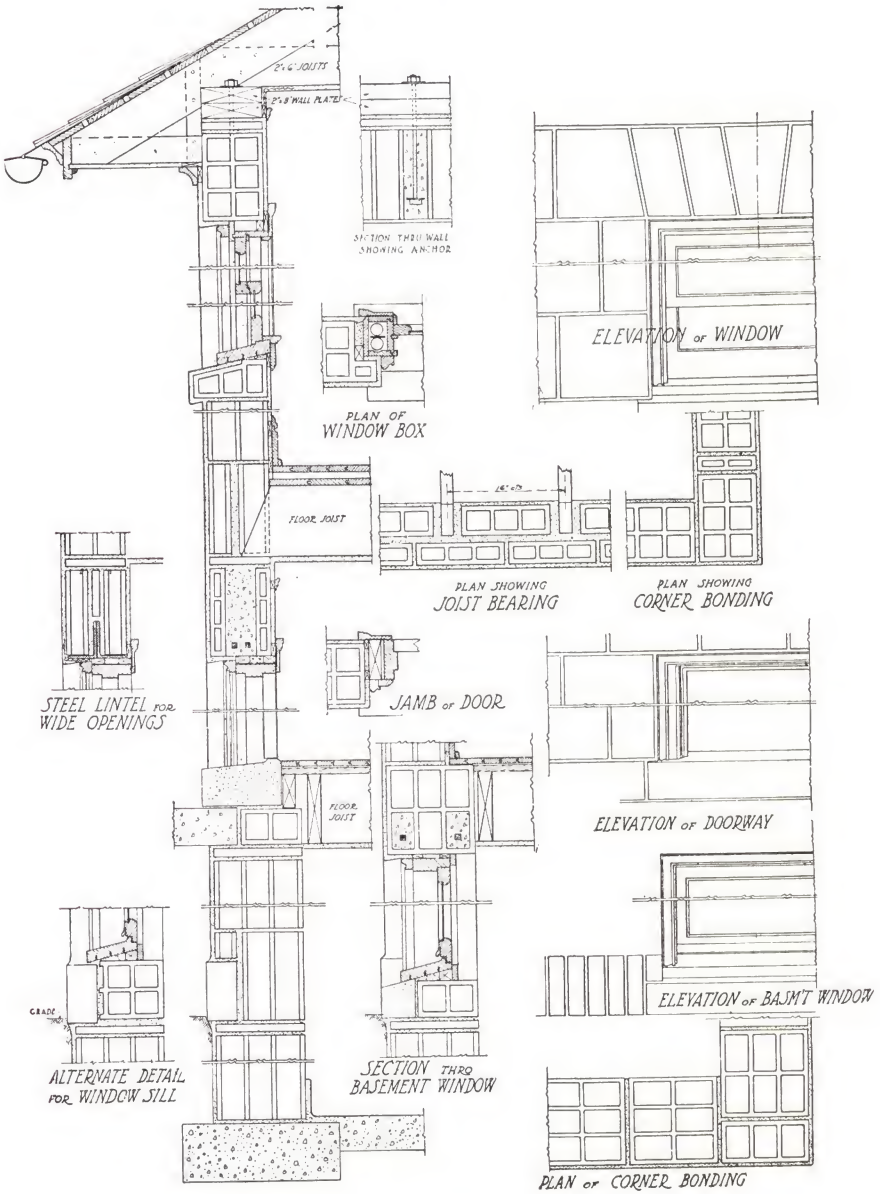
Isometric View—Side Construction

Typical Section Through Stuccoed Hollow
Tile Wall, Side Construction



Isometric View—End Construction

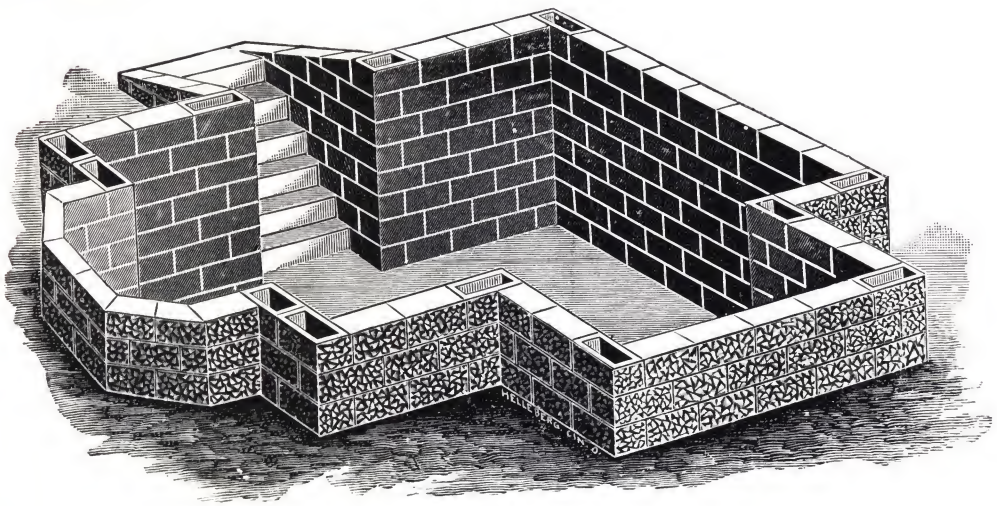
Typical Section Through Stuccoed Hollow Tile Wall, End Construction



Hollow Building Blocks

THE most important factors in the construction of a building are the foundation and the walls. Hollow Blocks have stood the tests requisite for a first-class building material. Their chief claims to favor are strength, beauty, durability, and moderate cost. That Hollow Blocks occupy a high place in the list of building materials, is beyond dispute by those best informed. More than ninety per cent of all bricks are made from alluvial clays, and, owing to their porous nature, absorb large amounts of water, which makes a brick wall very damp. Hollow Block, made largely from plastic fire clays, vitrifies in burning, is moisture proof and is free from conveying dampness through its walls. It is thoroughly fireproof, impervious to heat or cold, and is not affected by freezing.

In recent tests made by the United States Government, Pittsburgh Testing Laboratory and the Rose Polytechnic Institute, the average compression strength of an 8 x 8 x 16-inch block was shown to be about 200,000 pounds, or over 6,000 pounds per square inch of vertical wall, thus fully demonstrating that the crushing strength of these blocks is amply sufficient for almost any demands that may be made upon them.



Construction Suggestions

Stucco finish should not be applied in cold weather.

Window frames of a size that will fit in with the tile units without cutting should be used whenever possible.

Partly completed walls should be covered at night, particularly during bad weather, to protect the newly completed work against damage from rain, snow and frost.

Wood frames will shrink away from the masonry and therefore caulking while not necessary, is often advisable around doors and windows, particularly in exposed windy locations.

Hollow Tile should not be dumped from trucks or wagons. Each size or shape should be piled separately. Breakage will be avoided and a saving effected in the mason's time.

Tile should be so built in the wall that all open ends of the cells are sealed up to preserve the insulating value of the air spaces.

The large units in which Hollow Tile are made not only afford the simplest type of permanent construction, but permit of rapid building progress and considerable saving ir both labor and mortar.

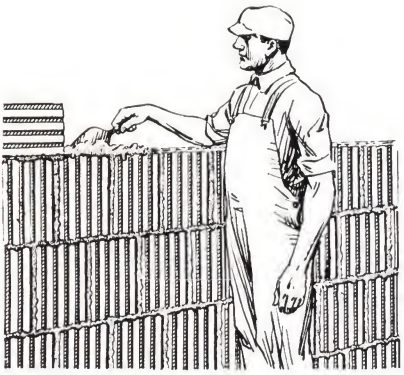
Stucco cannot crack or come off a hollow tile wall once it has been properly applied. There is a genuine bond between these materials and any attempt to separate them will demonstrate this, as the line of cleavage will not fail in the joint between the two materials.

In laying up vertical cell tile the masons or bricklayers should be instructed to butter the vertical joint surfaces of tile about 2½" to 3" in from the inner and outer faces leaving the center free of mortar, so that when laid in the wall through vertical mortar joints will be avoided as far as possible.

While in the majority of Hollow Tile residences the stucco and inside plastering is applied directly to the tile wall, it is recommended, especially in northern parts of the country, that the tile be furred and lathed on the inside. This adds to the insulation and overcomes any possible faulty construction.

The proper use of Hollow Building Tile is not at all difficult, if a few simple rules are understood. The method of bonding the walls at corners and around door and window openings and the maintaining of a proper break-joint bond throughout the wall, are easily mastered by anyone who can handle a trowel.

Hollow building tile as a backing for stucco is ideal; it does not shrink nor swell, has a low absorption value, contains no soluble salts, will not disintegrate, and has a surface that is both sufficiently rough and dense to insure the best bond between the two materials, and it further is scored with dovetail grooves that provide the strongest possible mechanical bond.



A waterproofing compound is recommended where an ordinary cement and sand mixture is used for the stucco finish. Such mortars rarely are of sufficient density to prevent entirely the absorption of moisture and a wall that shows dampness or does not dry out immediately after a rain is unsightly even though the dampness cannot penetrate the tile.

Estimating the quantity of tile required for a given building may be done roughly. It is only necessary to figure the square foot area of work to be done and multiply result by number of tile required to lay one square foot, adding for the lineal area of lintels, copings and for other special work. In ordering the tile, however, the quantities of the several shapes required should be carefully figured and clearly specified. In figuring quantities, all openings in walls over 4 square feet may be deducted.

The method of finishing walls should be settled before window frames are ordered. Stock window frames of the sizes best adapted to fit the Hollow Tile units with the least amount of cutting and fitting should be used. All window frames for use in walls finished with stucco should have either the regular staff beads or a staff moulding to finish up against the stucco. Staff bead should be full depth of outside casing where recessed jamb tile are not used.

Things to Avoid

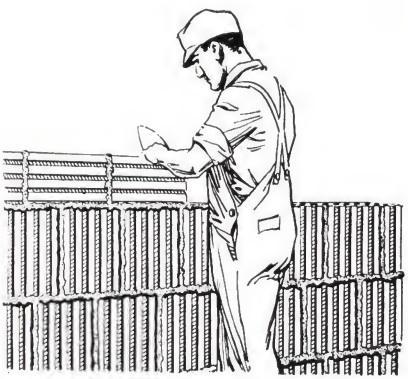
Don't forget to form drips under lintels and sills, also under belt courses or other projections.

Don't use arch lintels on wide openings and don't support arches on slender piers which do not provide the required abutment.

Don't permit your mason to break up a lot of tile for short pieces. It takes time and wastes material. Smaller shapes and the required quantity of fractional lengths should be specified when ordering the tile.

Don't run rafters for outside porch roofs through the tile wall; it is much simpler to bolt or anchor a bearer to face of wall and nail the joist or rafter to such a bearer. Every hole tends to weaken the wall and also throws out the regular bonding.

All horizontal flat surfaces should be avoided in stucco work. Belt courses should be formed with a good wash.



Method of Estimating Quantities of Tile Required

Take the length of each outside wall in feet and multiply by the height in feet which will give the superficial area in square feet, and then deduct for all window and door openings which are over 4 square feet in size. This will give the net area of each wall which, added together, will give the total net area of wall surface required.

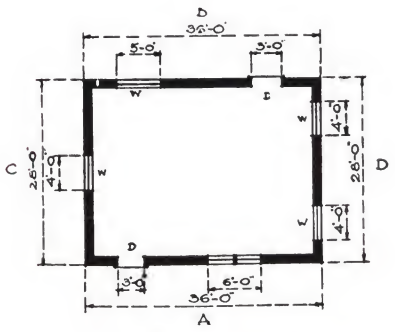


Fig. 981-A

In the illustration shown above, A and B are the same length and C and D are the same length, so we get:

		Sq. Ft.
Walls A and B	2 x 36'-0" x 14'-0"	1008
Walls C and D	2 x 28'-0" x 14'-0"	784
Gables C and D	2 x 28'-0" x 5'-0"	280
	Total	2072

Deduction for Windows and Doors:

		Sq. Ft.	
2 doors	3'-0" x 7'-0"	42	
1 window	6'-0" x 5'-0"	30	
1 window	5'-0" x 5'-0"	25	
3 windows	4'-0" x 5'-0"	60	
2 gable windows	3'-0" x 3'-0"	18	
		175	175
	Total Net Area in Sq. Ft.		1897

Now, 1897 sq. ft. equals the total net area or superficial feet of all walls.

In order to convert this into the number of tile required we first determine the thickness of the wall and the size of tile desired.

Assuming we desire an 8" wall and that 8x12x12 tile are to be used, by referring to the table, we find the figure 1.59 opposite 8" tile course. Then, 1897 multiplied by 1.59 which gives us 3016, is the number of tile required.

Fig. 981

Likewise, if an 8x5x12 tile was to be used in an 8" wall side construction, we would multiply 1897 by 2.2 which equals 4173, the number of tile required for tile courses 5" high.

Also, if a 12x12x12 tile was to be used in a wall 12" thick end construction, we would multiply 1897 by 1 which equals 1897, the number of tile required for tile courses 12" high.

HOW TO DETERMINE NUMBER OF TILE FROM SURFACE MEASUREMENTS

For	tile	course	4"	high	multiply	by 2.6
"	"	"	5"	"	"	" 2.2
"	"	"	8"	"	"	" 1.59
"	"	"	12"	"	"	" 1.0

LINTELS

In determining the quantity of lintels required for window and door openings, we add together the length of each window and door opening, allowing at least 6" bearing on each side of these window and door openings for the lintel to rest upon.

2 doors	3′-0″ long	8′-0″
1 window	6′-0″ "	7′-0″
1 "	5′-0″ "	6′-0″
3 "	4′-0″ "	15′-0″
2 "	3′-0″ "	8′-0″
	Total	44′-0″

44′ represents the lineal feet of lintel section required.

SILLS

Door sills	2 x 3	6 lin. ft.
Window sills	1 x 6	6 " "
" "	1 x 5	5 " "
" "	3 x 4	12 " "
Gable window sills	2 x 3	6 " "
		35 lin. ft.

The quantity of corners, joist course, sill, lintel and jamb or closure tile, should be figured separately and deducted from the straight wall area.

It the tile units are to be laid on the side, closures and half-closures will be necessary at the jambs of all straight openings unless these are to be closed by filling the ends of the tile with concrete. Where recessed box window frames are used, jamb tile and half-jamb tile will be required.

Some form of tile will be required for bonding the corners in any event and also some form for providing a bearing surface for joists and some form of tile for lintels will be required unless the regular straight wall tile is used by filling with concrete and reinforcing them for lintels.

To figure these items we take the lineal feet of lintels plus from 6″ to 9″ on each side of the opening for bearing over all regular window and door openings.

Figure also the lineal feet of sills from actual openings keeping door and window sills separate where a hollow tile sill is to be used. Frequently, however, the wood sill of window frames is set directly on the tile wall and no other shape provided or required for this purpose excepting where the tile are set on end. A course of tile slab should be used under all frames to cap off and close the cells in the tile.

The vertical lineal feet of jamb for all plain openings is figured for closures and vertical lineal feet of recessed box frame openings for jamb tile.

Where straight wall tile is used for regular lintels, the item for regular lintels is disregarded, otherwise, this item would be deducted at an equivalent area in square feet.

Window and door sills, if included, would be deducted at ½ square foot each. Lineal area of jambs to be deducted by averaging the jambs and half-jambs to equal ¾ foot per lineal foot. Closures and half-closures would be similarly averaged. Corner tile will be equivalent to ⅓ to ¾ square foot per lineal foot. Joist course is usually taken to equal one square foot per lineal foot.

These items for the house shown on our sketch will be as follows:

Window and Door Lintels	44 lin. ft
Door Sills	6 " "
Window Sills	29 " "
Jamb	66 " "
Closures	28 " "
Corners (4 x 14)	56 " "
Joist Course (2 x 36)	72 " "

Thus we will have approximately 222 square ft. to deduct, if all these items were to be provided for, giving the reduced area of straight wall tile as 1897 minus 222 = 1675 multiplied by 1.59 = 2663 pieces.

Now then, our completed quantities will read:

2663 sq. ft. of wall tile
44 lin. ft. lintel
6 " " door sills
29 " " window sills
66 " " jambs
28 " " closures
56 " " corners
72 " " joist tile

Laying Out the Building

It is best not to lay out the building until after the tile has been unloaded at the building site. Frequently tile may run a little under or oversize and by varying the dimensions of the building a couple of inches a lot of cutting can be avoided.

A quantity of tile should be measured up as they are unloaded from the wagons at the job to get the actual average size, as they frequently vary ¼" either way from given dimensions. Then lay out the length of 8 or 10 tile on a strip of wood, allowing from ⅜" to ½" for the mortar joints. Don't figure too scant; allow for the irregularity in the tile which may make joints that are much less than ½" not practical. The horizontal bed joints may run a little over ½" but the vertical joints should not exceed ½".

Take as an example a building where the plans call for a series of windows evenly spaced throughout the entire length of the side walls. First endeavor to select a window size that will work in with the tile units by having a width that will equal some multiple of full and half tile, then figure the piers between these windows also as the multiple of full and half tile. For instance, your plans might show the piers between windows 2'-8" in width; by reducing that figure to 2'-7", two full and one-half length tile could be used in each course for all piers throughout the wall, and if window sizes can be worked out on a similar basis, all cutting will be avoided and the result will be a much better looking wall; or the window frame sizes remain unchanged and the 1" difference be taken up in the blocking out of frames with strips nailed on the back.

It is seldom that much change in the dimensions of a building is necessary; 2" or 3" in 40'-0", 60'-0", or even greater length walls, is all that is required. Where a straight wall of any length over 20'-0" is built without openings it is a simple matter by a very slight variation in the joints to take up any such difference in dimensions, but where openings occur, it may not be possible to take up the difference, except at the corners and this is awkward.

Another thing to remember in laying out Hollow Tile buildings that are to be finished with stucco, is that the stucco will take ¾" or more off each side of the rough opening and add this thickness at corners. Foundations should therefore be made 2" longer than the Hollow Tile wall and rough tile openings should be made 2" wider than the desired finished size of masonry openings, or back to back dimensions of the outside staff beads on window frames.

A very large percentage of all the used for exterior walls is either the regular 8 x 5 x 12 building tile having courses 5" in height, or the standard 12 x 12 load bearing tile having courses 12" in height for any thickness of wall. The method of figuring story heights with these two forms of tile is therefore given and the story height for any other size or shape may be figured in the same general manner.

For the usual 8 x 5 x 12 building tile and other tile units that are laid on the side, it is customary to allow a half inch for the horizontal or bed joints. Therefore assume the course to equal 5½".

If 2" x 10" joist are used for the floor of a building with single floor above and sheathed ceiling below, it makes a total floor thickness of 12".

For residence buildings where 2" x 8" joist with double floors are to be used, where joists are not spaced close enough to permit the direct application of lath to underside of the joists, particularly when double floors are used, it is customary to cross-fur the ceiling with 1" x 2" strips laid either 12" or 16" center to center, which with the lath

Laying Out the Building

and plastering, calls for an allowance of 2" for ceiling thickness or a total floor thickness of 11" to 12".

Thus approximately 12" is added for floor thickness to any given clear story heights, and the number of courses required is indicated by Fig. 935.

Story heights and courses for barns, and hog houses would be figured as a basement or cellar story as indicated by Figures 929-E and 930, adding the depth required for the foundation wall below grade line.

Hollow Tile walls when foundations as well as the wall above grade is built of Hollow Tile, would be figured as follows:

wall, and to close up the cells and cut off the circulation of air within the cells at each story level. For the tile slab course a full 1½" should be allowed. Half length tile referred to as "half cuts," or brick if slabs are not available should be used where required to work out the story heights.

Fig. 930, indicates the number of courses required for various story heights where the 12" x 12" load bearing tile is used. Basement or cellar stories are figured in a similar manner.

When figuring height of upper stories the 2" thickness of roof plate must be allowed for. (Fig. 883-A.)

Should the slab courses at story levels not be used with the 12" x 12"

For height of ceiling	8'-6" or 9'-0"
Add for depth of foundation (3'-0" below grade and 6" above)	3'-6"
Height of wall above footings	12'-0" or 12'-6"
For the 8'-6" ceiling height:	
For 5" tile this requires 26 courses	at 5½" or 11'-11"
For 12" tile this requires 11½ courses	at 12½" or 12'-0"
For the 9" ceiling height:	
For 5" tile this requires 27 courses	at 5½" or 12'-4½"
For 12" tile this requires 12 courses	at 12½" or 12'-6"

Should the foundation for these buildings be built of concrete it is customary to extend the concrete wall about 6" or 8" above the floor line as shown by Fig. 935, which indicates the number of courses required for dairy barn walls.

For the standard load bearing tile that are made to be set with the cells vertical in the wall and which for any thickness of wall have a 12" x 12" face for 12" courses, it is quite customary to make the usual one-half inch allowance for the horizontal bed joints, but this is hardly sufficient in ordinary work and five-eighths inch is a safer average, giving some leeway in the leveling up of courses where there is a little variation in the size of the tile.

With this form of tile, the wall should be capped off at each story level with a course of tile slabs both to give a proper bearing for the joist and for the tile forming the joist course in face vertical cell tile, the method of figuring story heights is the same, except that allowance for slab course is omitted in figuring height of the tile and joints and the clear height for a given number of courses would therefore be about 1½" less than the figures already given. In such cases, however, the joist should be given a full bearing by resting on a half brick. This raises the floor level about 2" in relation to the tile courses and allowance for this difference should also be made when clear story heights are figured.

In laying out the story height for cellars where a portion of the wall is to be above grade line, it is generally advisable to consider the relationship between normal grade line and top of footing and provide for cellar window frames of a size that will fit in with the courses of Hollow Tile and have sills above grade, unless areaways are to be used around these windows.

Chimneys

Chimneys should always be built on a solid foundation resting on earth well below the first line, at level of footing, whether they are interior or exterior chimneys. They should not be corbelled out as a projection from a wall and the top of chimney should be carried up to at least 3'-0" above flat roofs and 2'-0" above ridge of peak roofs. When the building is surrounded by taller structures it may be necessary to carry the chimney higher in order to avoid down drafts.

Footing for chimneys should be at least 6" or 8" wider all around than the chimney foundation and for small chimneys should be 12" wider all around. All chimney flues should have a uniform 8" tile enclosing wall from the top of fireplaces (which may have greater thickness) to roof.

Only cement mortar should be used in the erection of chimneys, or a cement lime mortar in which the Portland cement used equals at least 50% of the cementing material.

The Necessity for Good Flashing

Wherever a roof over a porch or a lower gable roof comes in connection with hollow tile walls, flashing must be provided for.

Sheet lead makes a very desirable flashing although heavy gauged galvanized iron, if well taken care of, will answer the purpose.

This flashing should extend up the tile wall at least 6" or up to and into the first horizontal joint and should then be brought down over the shingle roof or prepared roof at least 6", as shown in Figs. 940 and 941.

This will make a permanent water tight joint as long as the flashing lasts which, in the case of sheet lead, is indefinite; but in the case of galvanized sheet iron care must be taken to keep the exposed surface well painted.

Window Sills

Outside window sills may be formed of sill tile or of a course of 3" or 4" thick Hollow Tile laid flat and finished in stucco or of brick on edge, or sawed stone, or cast concrete.

In walls of farm buildings that are built of 8 x 5 x 12 tile laid flat outside window sills are frequently omitted, the window frame being set sufficiently close to face of wall so that the wood sill will project a little beyond face of tile.

In setting either brick, concrete or sawed stone sills on Hollow Tile walls that are to be stuccoed. an ample projection from the face of wall should be allowed so that they will have a projection of at least ¾", preferably a full inch beyond the face of finished wall.

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